Technical Reference Manual

Design and Application Guide for Honeywell Economizer Controls

Honeywell

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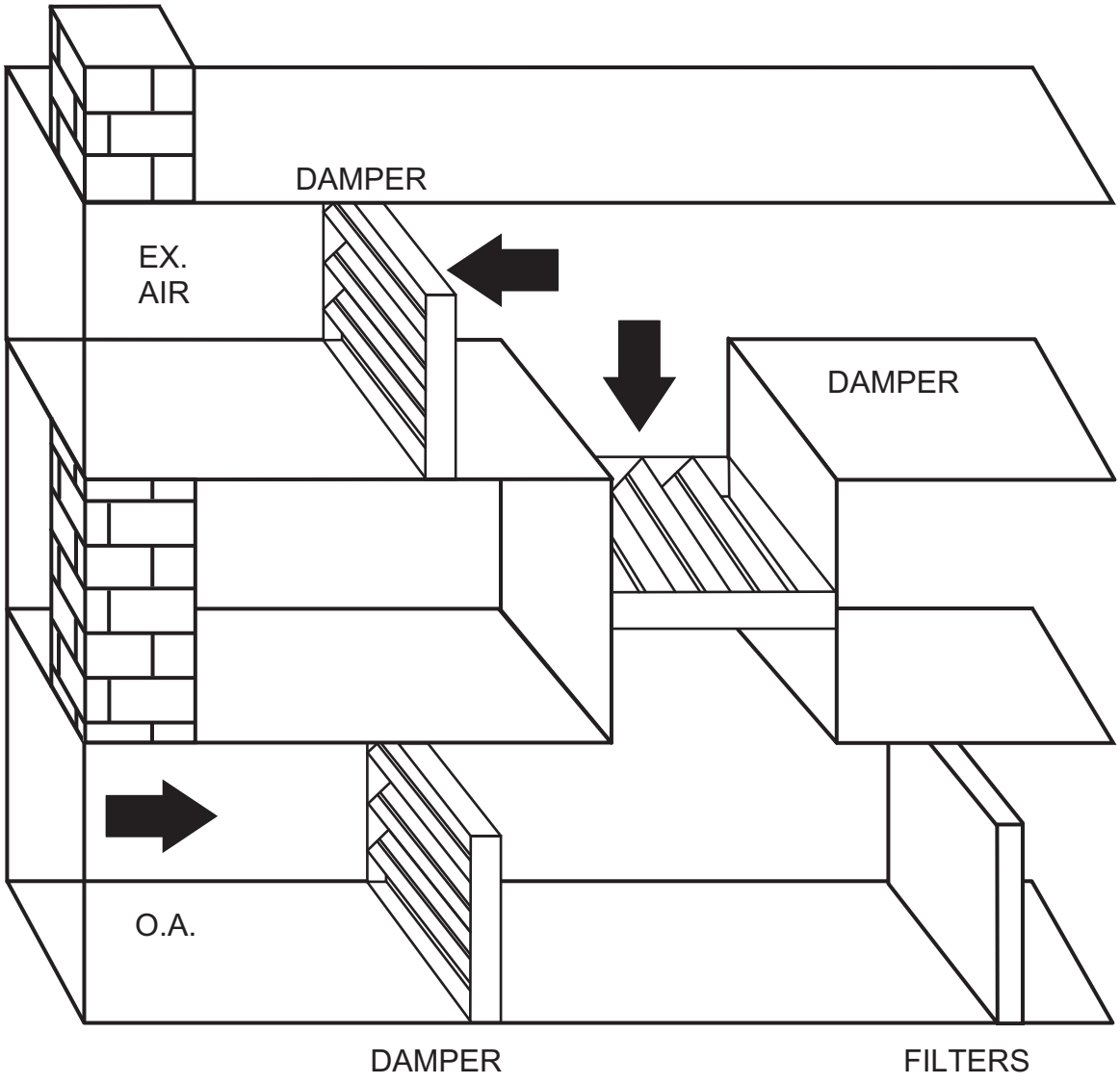
Section 1 - Ventilation



MIXED AIR SECTION

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Indoor Air Quality

The characteristics of the indoor climate of a building, including the gaseous composition, temperature, relative humidity, and airborne contaminants.

The Arab oil embargo of 1974 caused many building designers to begin implementing utility cost reduction measures. One of these measures was to seal up the building shell to reducing exfiltration of indoor air and the resultant heat loss. Utility costs were reduced but there was a significant negative side effect that was not detected until 1988: Indoor Air Quality. Many buildings constructed prior to 1974 had sufficient leakage through poorly sealed windows and doors to adequately ventilate the building. Construction methods used between 1974 and 1988 substantially reduced this leakage. As a result many buildings constructed between 1974 and 1988 are not adequately ventilated.

As the energy costs continue to rise into the beginning of the 21st century, building managers are seeking ways to reduce the energy usage in new and existing buildings and continue to provide a healthy environment for the building occupants.

Healthy Air

Building-Related Illness

A diagnosable illness with identifiable symptoms whose cause can be directly attributed to airborne pollutants within a building such as Legionnaires disease or hypersensitivity pnuemonitis.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) are engineers in the HVAC industry who establish standards for the mechanical equipment used to heat, cool and ventilate buildings. The local, state, national and international buildings codes are based on these standards. ASHRAE Standard 62.1 is the ventilation standard. It states “indoor air quality is acceptable when there are no known contaminants at concentrations determined to be harmful to building occupants, as determined by cognizant authorities, and when a substantial majority (80% or more) of those persons exposed to the indoor air do not express dissatisfaction with its quality.” This standard establishes minimum outdoor air ventilation required to provide a healthy environment for the building occupants.

Symptoms of Inadequate Ventilation

Headaches

Dizziness

Drowsiness

Fatigue

Nausea

Eye Irritation

Respiratory Irritation

Causes of poor indoor air quality are not always caused by the design of the building. Poor or improper maintenance such as outdoor air dampers that are blocked open or completely closed, defective damper actuators or incorrectly set or malfunctioning controls may also cause inadequate ventilation. Many maintenance people respond to occupant complaints with only temperature in mind. If the room is within the acceptable temperature range of 68 to 78°F. (20 to 26°C) it is perceived that no adjustments are necessary. The occupants may have many of the symptoms listed above but do not have the knowledge to request “open the outside air damper” or “increase the volume of supply air to this room.” It is incumbent on the knowledgeable HVAC service person to recognize inadequate ventilation when it is encountered.

Indoor Air Ventilation Standards

ASHRAE is continually updating the ventilation standard (ASHRAE 62.1) to provide guidelines for design and maintenance of buildings. These standards are recommended guidelines only and are not legal requirements. However many state and local codes use the ASHRAE standards as the basis for building codes for new construction and building occupancy. They also form a basis for litigation in indoor air quality lawsuits.

Some measurements and chemicals referred to in the standards may not be familiar to the average person in the HVAC industry. However the majority of the information contained in these standards is very clearly stated. Everyone in the HVAC industry should be knowledgeable about the contents of these standards.

The ventilation standard states a minimum outdoor air ventilation rate required per person per type of environment in Cubic Feet per Minute (cfm). The ventilation requirement varies between occupied and unoccupied periods. Outdoor air dampers are set to a minimum position based on the maximum occupancy level for the space. To save energy costs the ASHRAE 62.1 standard also allows ventilation to be based on sensor input that determines occupancy. This is commonly referred to as demand control ventilation (DCV).

CO_2 Based Demand Control Ventilation

CO_2 is a fairly dependable indicator of the concentration of the odorous bioeffluents exhaled by human beings. Therefore we can use CO_2 concentration levels in a space to determine the human occupancy and reduce outdoor air intake when the space is not occupied to the maximum design occupancy level. DCV is an energy conservation measure; its purpose is to reduce outdoor air intake rates and the energy required to condition the outdoor air when spaces are not occupied at maximum design densities.

For those who do not want to read an engineering standard, the ASHRAE 62.1 committee has written a user manual that:

- offers information on the intent and application of Standard 62.1
- provides sample calculations and examples.
- provides useful reference materials.
- gives guidance to building operation and maintenance personnel.

Standard 62.1 Ventilation for Acceptable Indoor Air Quality (ANSI Approved)

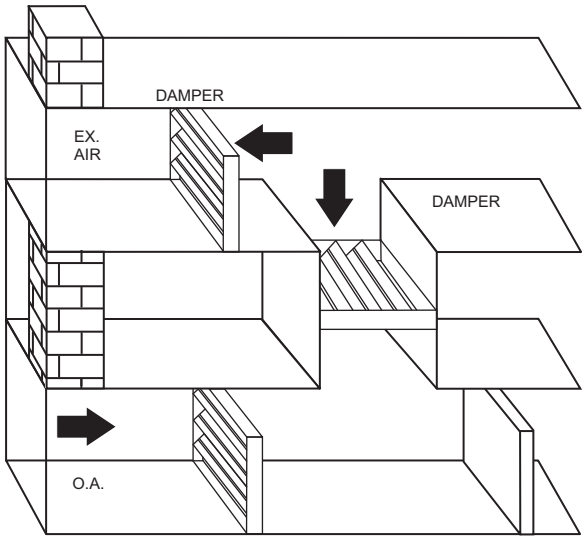
Order from
ASHRAE Publications Sales
1791 Tullie Circle, N.E.
Atlanta, GA 30329 or

www.ashrae.org

Ventilation Requirements

Ventilation is defined as the process of bringing outside air into a building. The four major reasons for ventilation are:

1. To ensure a healthy atmosphere. Ventilation is used to dilute indoor contaminants and provide fresh air for breathing.
2. To pressurize the building. Positive pressure inside a building prevents infiltration of unconditioned and unfiltered outside air through openings.
3. To provide atmospheric cooling. Bringing in cool outside air is more energy efficient and less costly than using mechanical cooling equipment.
4. To replace air that is being exhausted. The term for this is make-up air. Whenever air is exhausted, replacement air must be provided.



MIXED AIR SECTION

The mixed air controls are used to maintain a minimum ventilation volume at all times. This is in addition to controlling the dampers for atmospheric cooling.

Determining the amount of ventilation required for a space is probably one of the hardest an engineer faces in the design of the ventilation system. Section 6 of ASHRAE 62.1 offers two procedures designers can use to determine ventilation rates, Ventilation Rate Procedure (VRP) and the Indoor Air Quality Procedure (IAQP).

The VRP method is based on typical spaces and usage, the rates are intended to dilute and exhaust bioeffluents from occupants and building contaminants to satisfy the 80% of the occupants of the space. There are two sources of contaminants in a space that ventilation is intended to reduce: Occupants and their activities (e.g., use of office equipment) and Off-gassing from building materials. The ventilation rate in the breathing zone (V_{bz}) required for both people related sources (V_p) and building related sources (V_a) is:

$$V_{bz} = V_p + V_a$$

V_p and V_a both have two components; V_p is the number of people in the space (P_z) times the occupant comfort factor R_p (minimum ventilation rate determined by extensive studies for occupant comfort based on activity level in the space) and V_a is the area of the space (A_z) times the building component factor R_a (minimum ventilation rate determined by extensive studies for occupant comfort based on type of space). Therefore ventilation required in the breathing zone becomes:

$$V_{bz} = R_pP_z + R_aA_z$$

R_p and R_a values are found in ASHRAE 62.1 User's manual (Table 6-A) and ASHRAE 62.1 Standard.

The outdoor air or recirculated air may be cleaned using a filter or air cleaner but the outdoor air ventilation rates cannot be reduced below the rate determined by the above formula.

The IAQP method is used for spaces where the designers target a specific contaminant and control the level of the contaminant concentration. This method has two requirements: Maintain concentration of specific contaminant(s) below target concentration limits and achieve a design target of perceived indoor air quality acceptability. The IAQP method allows ventilation rates to be lower than the rates required by the VRP method if it can be demonstrated the resulting air quality can meet the required criteria.

The IAQP procedure has 4 steps:

- Identify the contaminants of concern.
- Determine acceptable concentration of contaminant(s).
- Specify the perceived indoor air quality criteria.
- Apply an acceptable design approach to achieve the performance criteria.

Additional information on ventilation and the two methods used to determine the ventilation rates can be found in ANSI/ASHRAE Standard 62.1 and in the User's manual for ANSI/ ASHRAE Standard 62.1. Both documents are available on the ASHRAE website at http://resourcecenter.ashrae.org/store/ashrae/

Example using the VRP method: Office space of 6600 sq. feet with maximum occupancy of 7 persons per 1000 ft^2.

$V_{bz} = R_pP_z + R_aA_z$ where
R_p = 5 cfm per person
(Table 6-A ASHRAE 62.1 User's Manual)
P_z = 7 person per 1000 ft^2 x A_z
R_a = 0.06 cfm per ft^2
(Table 6-A ASHRAE 62.1 User's Manual)
A_z = 6600 ft^2.

V_{bz} = 5 ft^3 / min/person x 7 persons/1000 ft^2 x 6600 ft^2 + 0.06 ft^3/ min/ft^2 x 6600 ft^2
= 231 cfm + 396 cfm
=627 cfm

For a single zone system V_{OT} (outdoor ventilation) is the same as V_{bz}. For multiple zone systems a zone air distribution system effectiveness (E) factor needs to be used in the calculation of the V_{OT}. See ASHRAE Standard 62.1 for method.

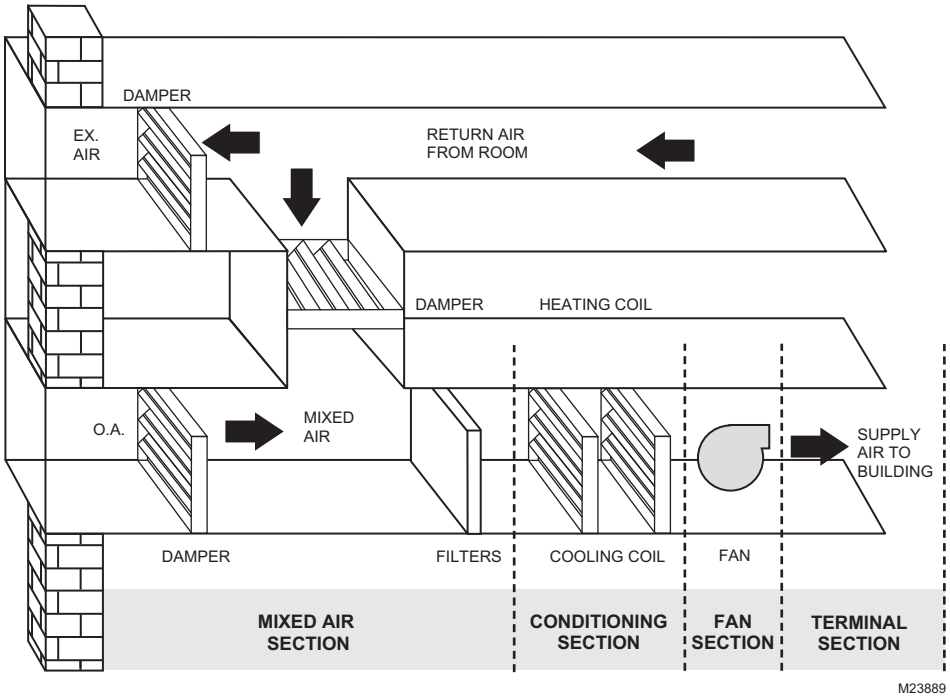
In our example during maximum occupancy the ventilation is 627 cfm. When the occupancy rate is less than the maximum occupancy, the ventilation rate can be adjusted to a lower occupancy and the ventilation increased as the CO_2 level in the space increases. This can be done following these steps:

- Calculate the V_{OT}.
- Use $V_{bz} = R_pP_z + R_aA_z$, where $P_z = 0$. This is the new ventilation rate V_{at} (the area building based component).
- Add a CO_2 sensor to the space.
- Adjust the CO_2 maximum to the V_{bz} (for maximum occupancy).
- Adjust the minimum position for occupancy for V_a.

In our example the V_{bz} ventilation is 627 cfm and the minimum position (V_a) is 396 cfm. Using a CO_2 sensor for Demand Control Ventilation, the new minimum position is set for 396 cfm and the maximum damper position for occupancy ventilation is 627 cfm. When one person enters the space or the commercial thermostat goes into occupancy mode, the outdoor air dampers will open to bring in 396 cfm of outdoor air. As space occupancy increases, the CO_2 level will increase and the outdoor air dampers will modulate open to the maximum of 627 cfm of outdoor air.

NOTE: When the commercial thermostat calls for free cooling using an economizer, the dampers are still allowed to override the DCV maximum position for ventilation and open the damper 100% open for free cooling.

Air Handler Control Loops



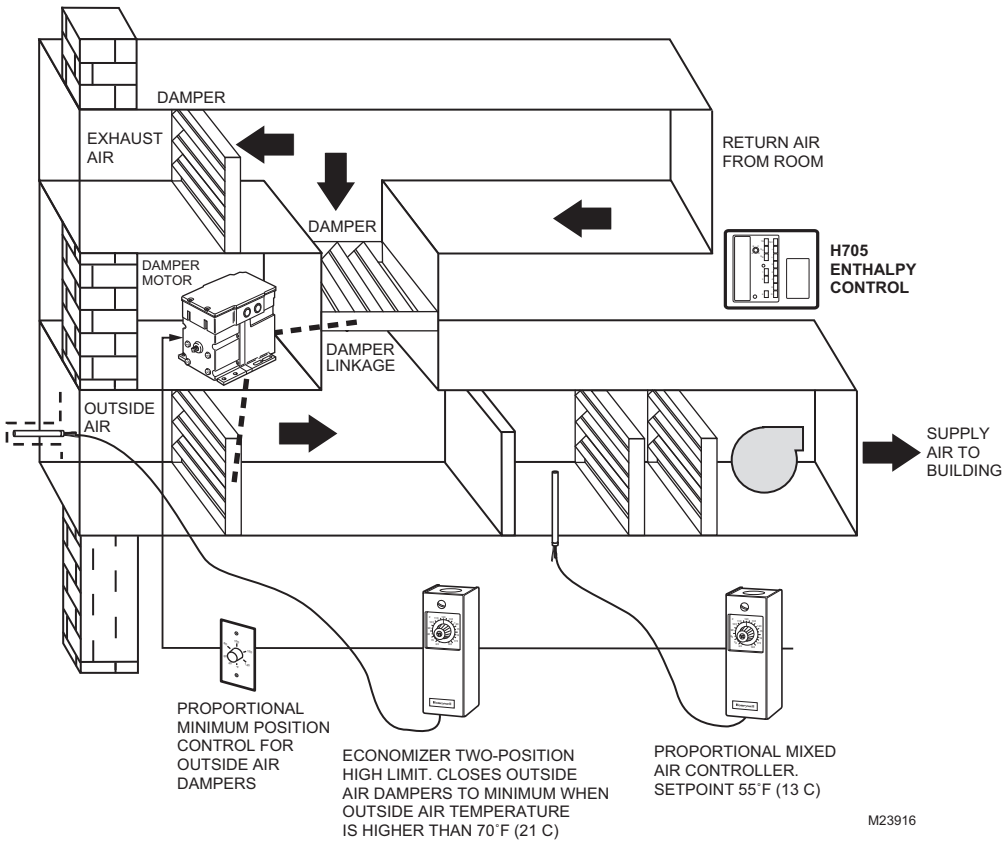
There are typically four sections of an air handler. The **Mixed Air Section** is where return air and outside air are combined (mixed). Some fans may be 100% return air or 100% outside air and will not have a mixed air section.

The **Conditioning Section** commonly contains filtration, heating, cooling and humidification. The filters and heating and cooling coils are located in the conditioning section of the air handler.

In the **Fan Section** on the air handler shown there is a supply fan. On other air handlers there may be a return or exhaust fan. The supply fan on this unit is referred to as a pull-through because it is located on the outlet of the coils. If it were located in front of the coils then it would be a push-through fan.

The **Terminal Section** is composed of all the components between the central fan and the zones.

Basic Economizer Control



Shown is the most basic temperature based electric economizer control configuration. The averaging element mixed air controller with the sensing element is located in the duct before the cooling or heating coils and maintains the mixed air at 55°F (13°C). A two position limit controller with sensing element in outdoor air is used to close the outside air dampers to a minimum position if the outdoor air temperature is too warm to use for cooling.

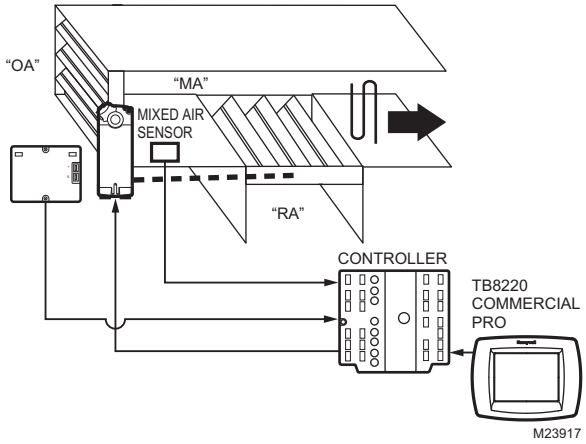
There is a minimum position control on most air handlers. The function of this control is to ensure proper ventilation. The control provides adjustable damper positioning between 0 and 100%. The outdoor damper position must be set for minimum ventilation requirements based on building occupancy as defined by state or local code.

NOTE: A setting of 25% does not produce 25% airflow because the flow through dampers is nonlinear.

It is important to know how much outside air is being brought into a building through the outdoor dampers on the air handlers. When the return and mixed air temperatures can be measured there is a formula used to calculate the settings that will provide the desired quantity of outside air.

A second formula is used to calculate the mixed air temperature when the outside air temperature, the return air temperature and the required percentage of outside air are known. Using the formula $V_{bz} = V_p$ we know the total ventilation and volume required.

Mixed Air Formulas



$$\frac{\text{Return Air Temperature} - \text{Mixed Air Temperature}}{\text{Return Air Temperature} - \text{Outdoor Air Temperature}} \times 100\% = \text{Volume (\%) of Outside Air}$$

Formula for Measuring the Percentage of Outside Air in an Air Handler.

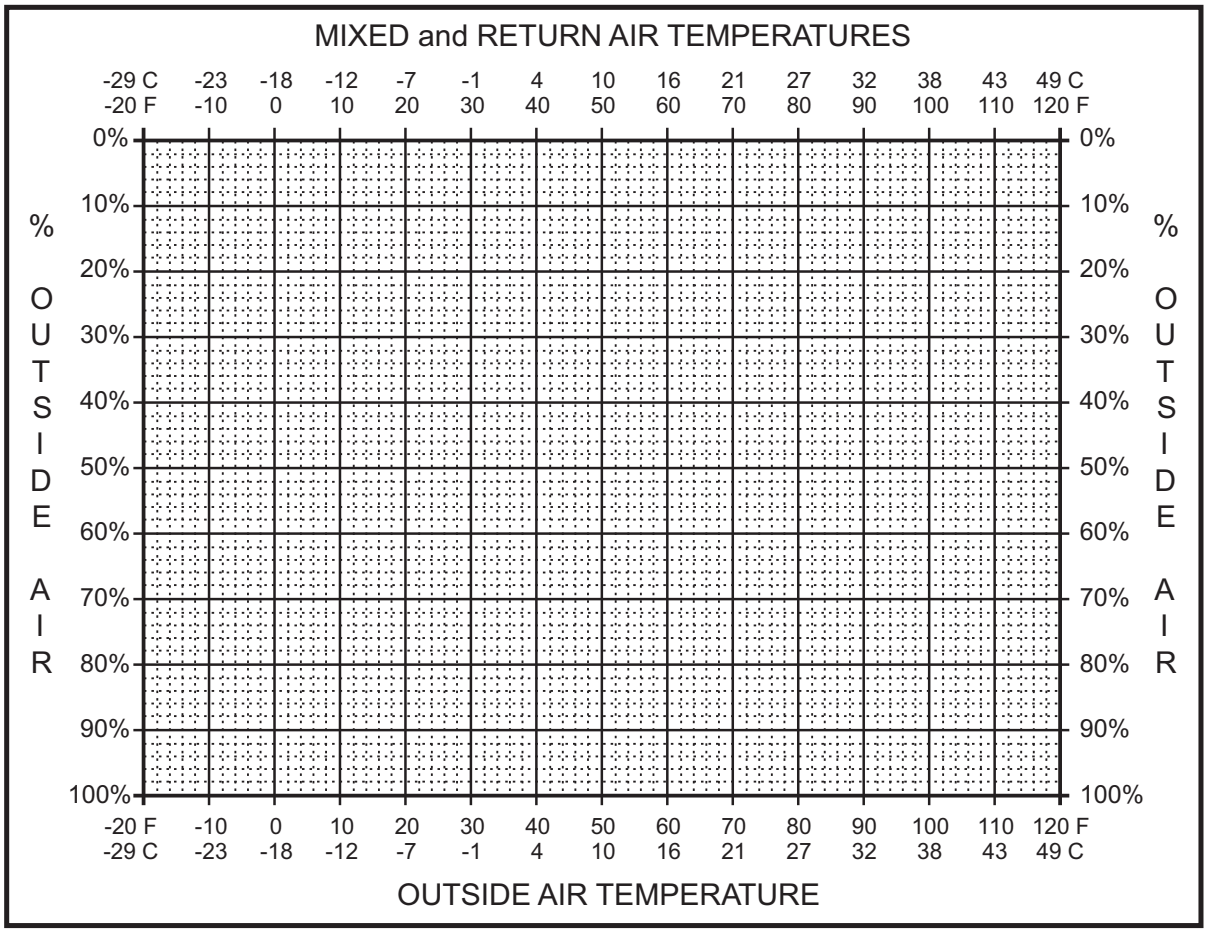
This formula is used to determine the percentage of outside air by volume that is being brought into a building from the outside. The OA dampers can be adjusted by measuring the MA, OA and RA to balance the correct V_{bz}. It is a test that should be conducted during routine maintenance to ensure that the correct percentage of ventilation is being provided.

$$\left[\text{Return Air Temperature} \times \text{\% of Return Air}\right] + \left[\text{Outside Air Temperature} \times \text{\% of Outside Air}\right] = \text{Temperature of Mixed Air}$$

Formula for Adjusting the Minimum Position Control.

This formula is used to make adjustments to the mixed air controls. In ASHRAE 62.1 there are two components of the percent of outdoor air ventilation required, the human component and the buildings effluent component. The rates in the standard are based on the type of human activity normally performed in the building. For example: the base rate for office buildings is 5 cfm per person and the building effluent rate is 0.06 cfm per square foot of space. Initially only two temperatures are measured, return and outside air. The minimum position control is then adjusted until the mixed air temperature is equal to the result of the formula. For design requirements for CFM per person for all building types, refer to ASHRAE standard 62.1 section 6 and/or local or state building codes.

Outside Air Percentage Chart



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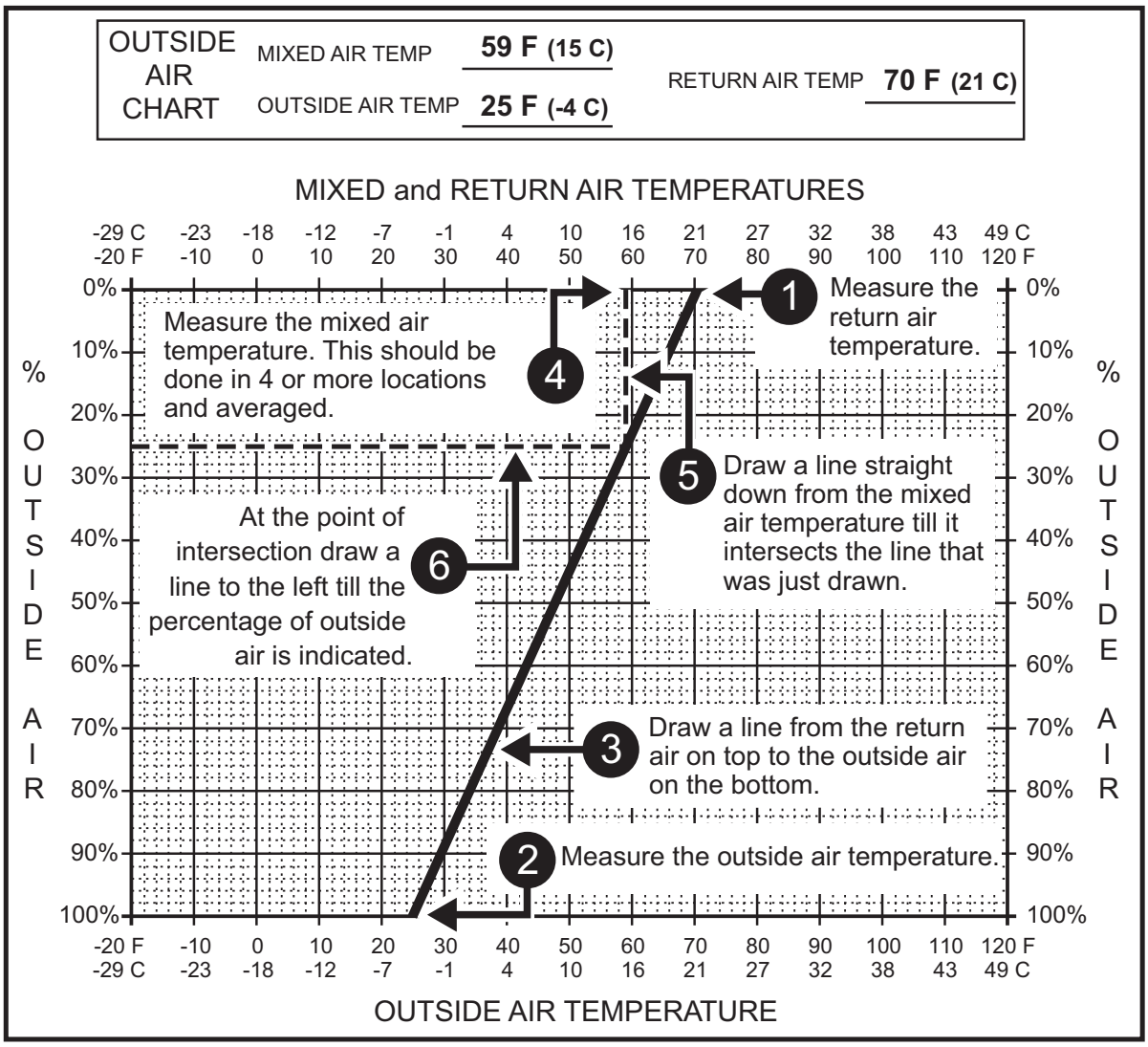
This chart can also be used for measuring the percentage of outside air on an air handler. The same three temperatures are measured per the formulas on the preceding page. Lines are drawn on the chart using a ruler. As with the formulas this chart is most effective if there is at least a 10 degree F difference between the return and outside air. This will typically require either a warm or cold day rather than moderate weather. It is more accurate to measure outside air percentage on a day when the outside temperature is 10°F (-12°C) rather than on a day when it is 70°F (21°C). If the temperature difference between the return and outside air is only a few degrees, a small error in measurements can alter the results by as much as 50% using this method. If the temperature difference is 40 or 50°F (22 or 28°C) small errors in measurement do not substantially affect the results of the calculations.

Example 1: Using the Outside Air Percentage Chart



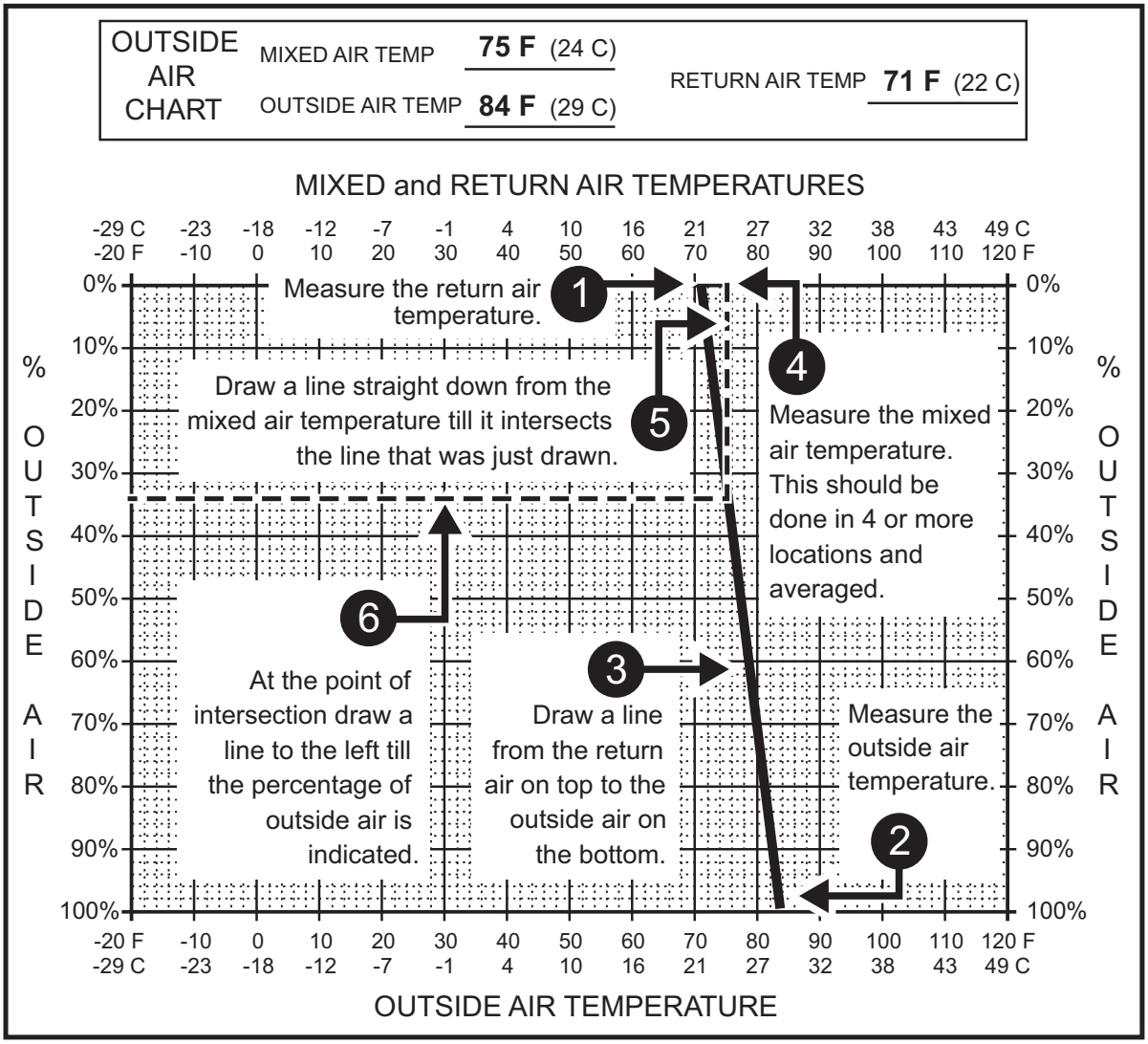
1. Measure the return air temperature.
2. Measure the outside air temperature.
3. Draw a line from the return air temperature to the outside air temperature.
4. Measure the mixed air temperature in multiple locations and determine the average.
5. Draw a line down from the mixed air temperature to the point where it intersects the first line.
6. Draw a line from the point of intersection to the outside air percentage on the left side of the chart.

According to the results from this chart this air handler is supplied with 26% outside air. If the total supply volume is 20,000 cubic feet per minute (cfm) (566 m^3/min) then:

0.26 X 20,000 cfm of total supply air equals 5,200 cfm of outside air (147 m^3/min).

This indicates that when the measurements were done on this air handler the total volume of outside air in the mixed air was 5,200 cfm of outside air (147 m^3/min).

Example 2: Use of Outside Air Chart on a Warm Day



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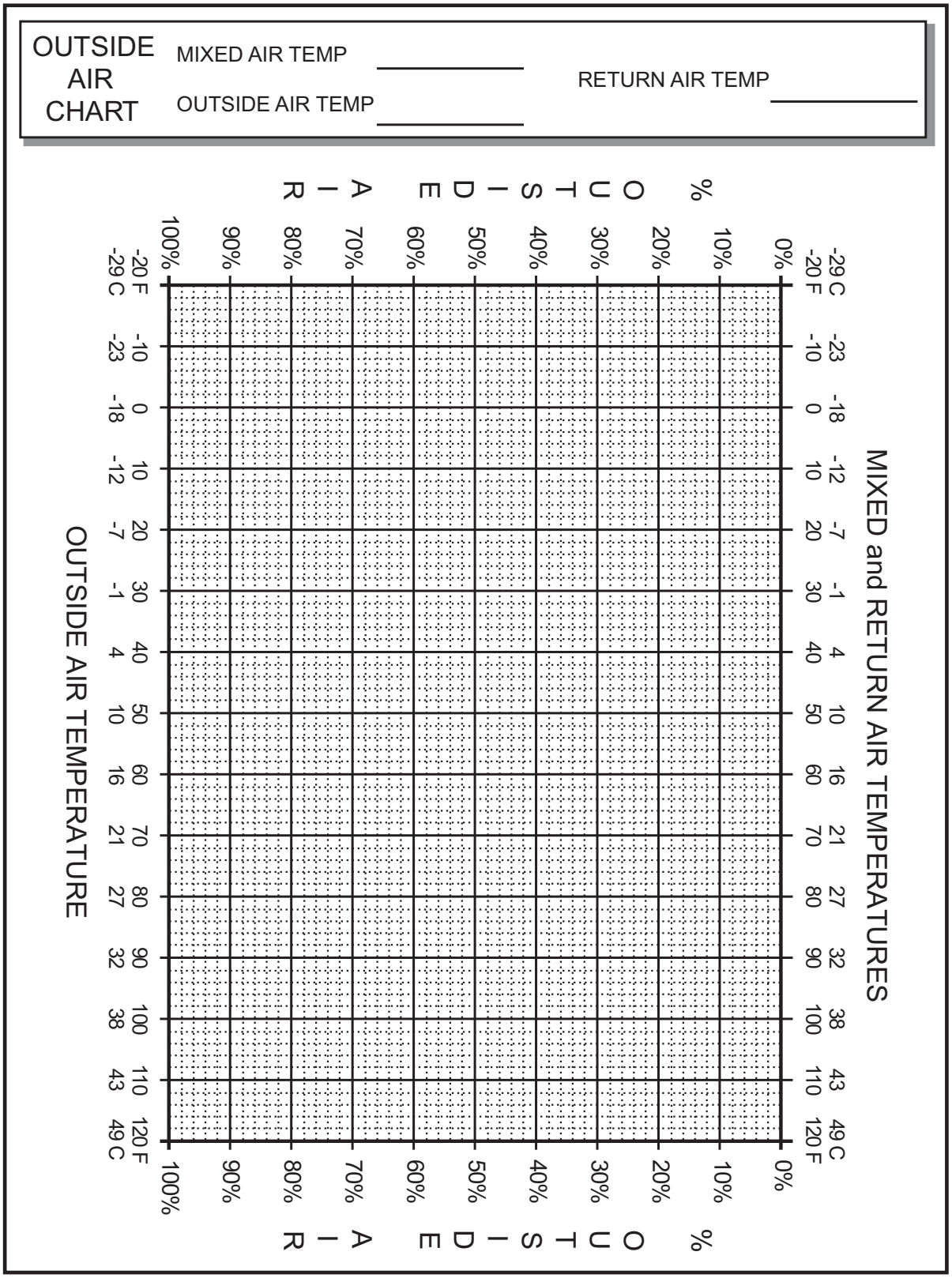
The chart can also be used on a warm day when the outside air temperature exceeds both the return and the mixed air temperatures. The first line drawn will slant in a different direction. Once again it is best to do this test when there is a minimum of 10 degrees F difference between the outside and return air.

Extra Outside Air Percentage Chart



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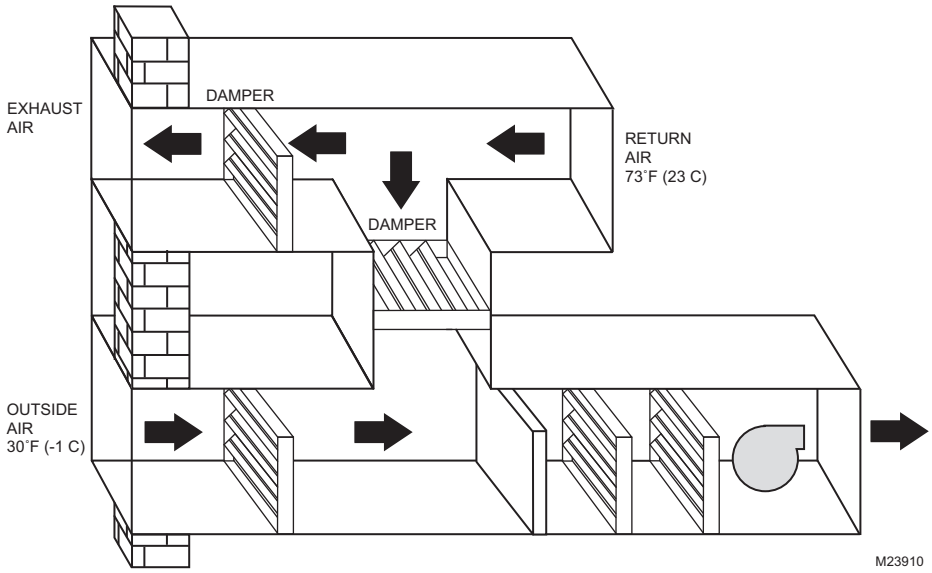
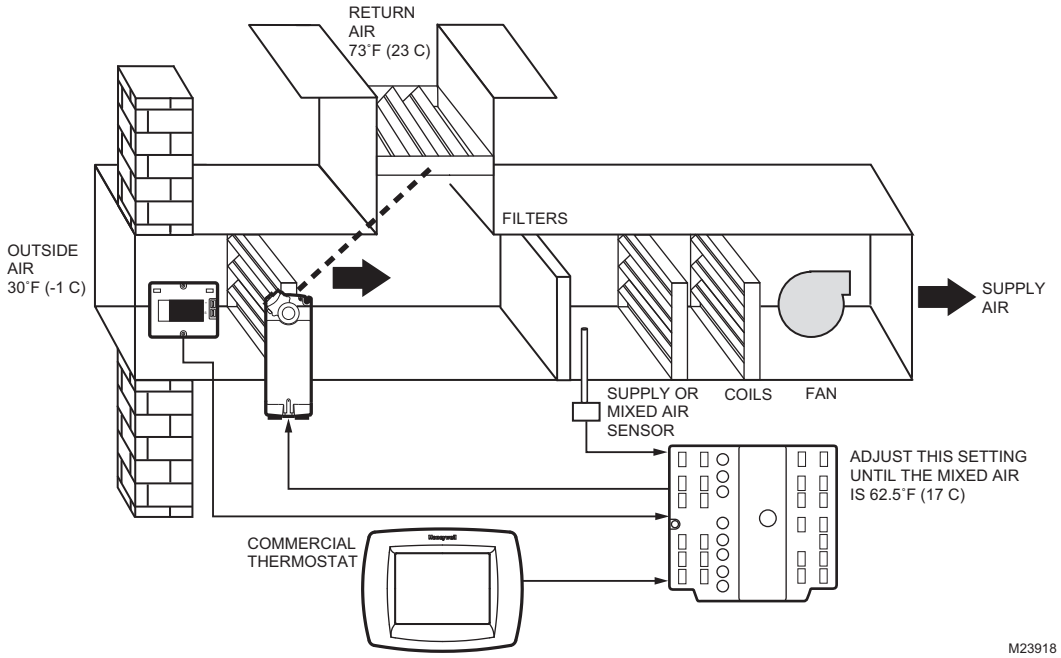
Example 3: Minimum Ventilation Adjustment



1. **Specifications:**
   Office space - 100,000 ft^2
   Air handler capacity 20,000 cfm
   (566 m^3/min.)
   People in area - 250
2. Ventilation (V_{OT}) required:
   = 250 x 5 cfm + 0.06 cfm/ft^2 x 100,000 ft^2
   = 1250 cfm + 6000 cfm
   = 7250 cfm
   Where V_{at} = 0.06 cfm/ft^2 x 100,000 ft^2.
   Therefore V_{at} = 6000 cfm
3. Ventilation percentage:
   7250 cfm (205.3 m^3/min)/20,000 cfm
   (570 m^3/min)
   V_{OT} maximum position= 36%

   6000 cfm (169.9 m^3/min)/20,000 cfm
   (570 m^3/min)
   V_{OT} Minimum position= 30%
4. Measure the return air temperature:
   73°F (23°C).
5. Measure the outside air temperature:
   30°F (-1°C).

This example shows a procedure for adjusting the DCV maximum and minimum positions.



Return Air Temperature X **% of Return Air** + **Outside Air Temperature** X **% of Outside Air** = **Temperature of Mixed Air**

6. Use the mixed air temperature formula or the graph to determine the Demand Control Ventilation maximum MAT:

73°F (23°C) X **64%** + **30°F (-1°C)** X **36%** = **Temperature of Mixed Air**

46.7°F (8.2°C) + **10.8°F (-11.8°C)** **57.5°F (14.2°C)**

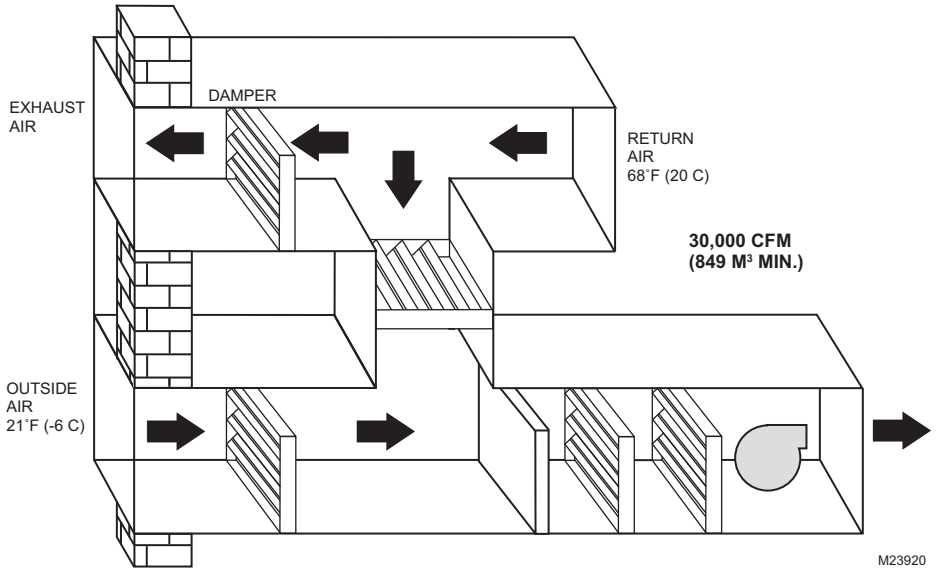
7. Use the mixed air temperature formula or the graph to determine the minimum position MAT:

73°F (23°C) X **60%** + **30°F (-1°C)** X **30%** = **Temperature of Mixed Air**

43.8°F (8.2°C) + **12°F (-11°C)** **55.8°F (13.2°C)**

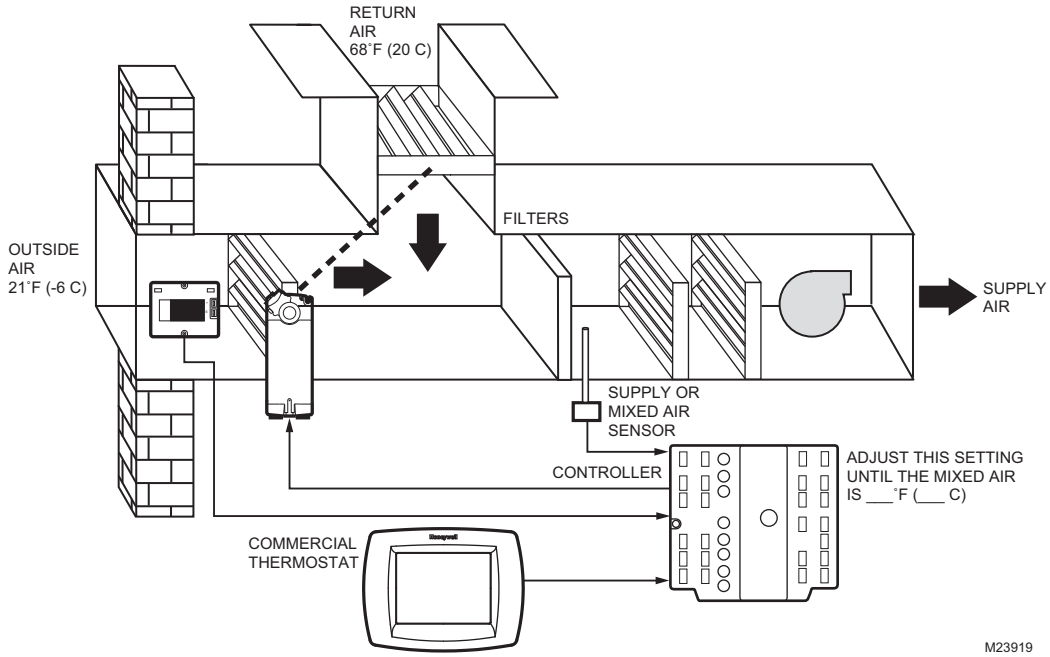
8. Close the outside air dampers. The method used for this depends upon the controller being used.
9. Turn the DCV maximum position control (pot) until the measured mixed air temperature is 57.5°F (14.2°C).
10. Mark this setting on the control as being 36% outdoor air.
11. Close the outside air dampers. Turn the minimum position control (pot) until the measured mixed air temp is 55.8 °F (13.2°C).
12. Mark this setting on the control as being 30% outdoor air.

Example 4: Ventilation Review Questions



1. **Specifications:**
   Office space - 200,000 ft^2.
   Air handler capacity - 30,000 cfm (849 m^3/min)
   People in area - 350
2. Ventilation required:
   =350 x 5 cfm per person + 0.06 cfm/ft^2 x 200,000 ft^2
   =1750 cfm + 12,000 cfm
   =13750 cfm
3. Ventilation percentage:
   13750 cfm (389.4 m^3/min)/30,000 cfm (849 m^3/min)
4. Measure the return air temperature: 68°F (20°C)
5. Measure the outside air temperature: 21°F (-6°C)

This is the air handler for an office building with 350 people maximum occupancy. Complete the required steps in the procedure to adjust the controls for the correct volume of ventilation.



Return Air Temperature X **% of Return Air** + **Outside Air Temperature** X **% of Outside Air** = **Temperature of Mixed Air**

6. Use the mixed air temperature formula or the graph:

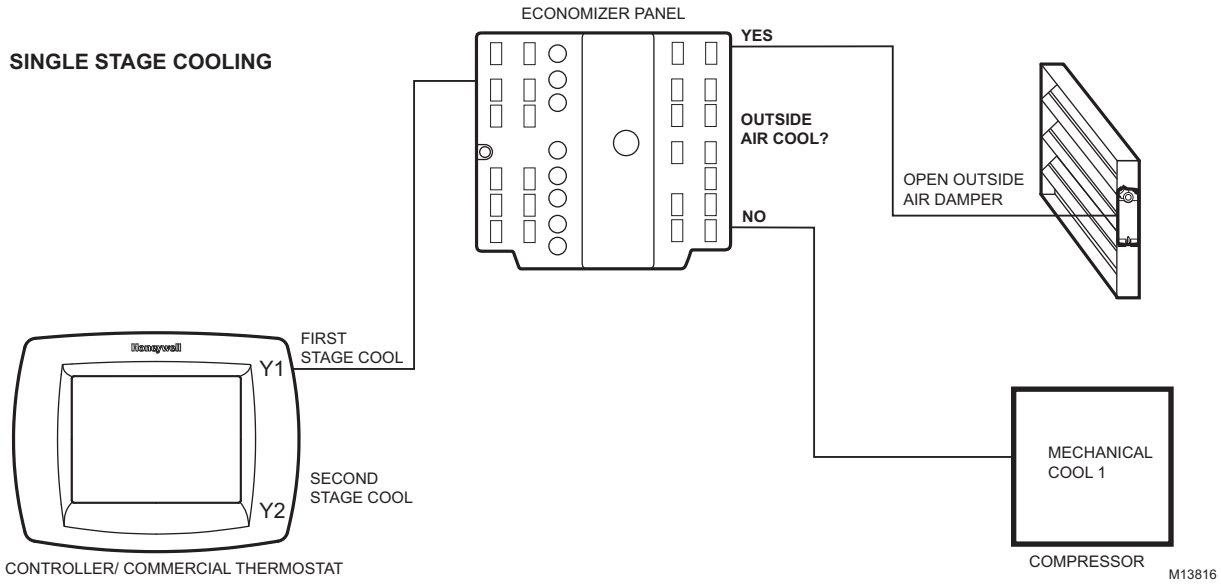
68°F (20°C) X **____%** + **21°F (-6°C)** X **____%** = **Temperature of Mixed Air**

_____°F (____°C) + **_____°F (_____C)** **_____°F (____°C)**

NOTE: Note use this formula to determine DCV maximum MAT and Minimum position MAT.

7. Close the outside air dampers to the minimum position.
   The method used for this depends upon the controller being used.
8. Turn the DCV maximum control (potentiometer) until the measured mixed air temperature is _____°F (_____ °C).
9. Mark this setting on the control as being _____% outdoor air.
10. Turn the minimum position until the measured mixed air temperature is _____°F (_____°C).
11. Mark this setting on the control as being _____% outdoor air.
12. Restore all settings and setpoints.

Economizer Cycle Definition



On a First Call for Cooling From Commercial Thermostat (Y1)

Controller signal is routed to the economizer logic module.

IF THE OUTDOOR AIR IS SUITABLE FOR FREE COOLING:

Actuator modulates the outdoor damper open until the room temperature is cool enough to satisfy the call for cooling and maintain the mixed or discharge air between 50 and 55°F (10 and 13°C).

When the mixed or discharge air is between 50 and 55 °F (10 and 13°C) the actuator will hold damper position.

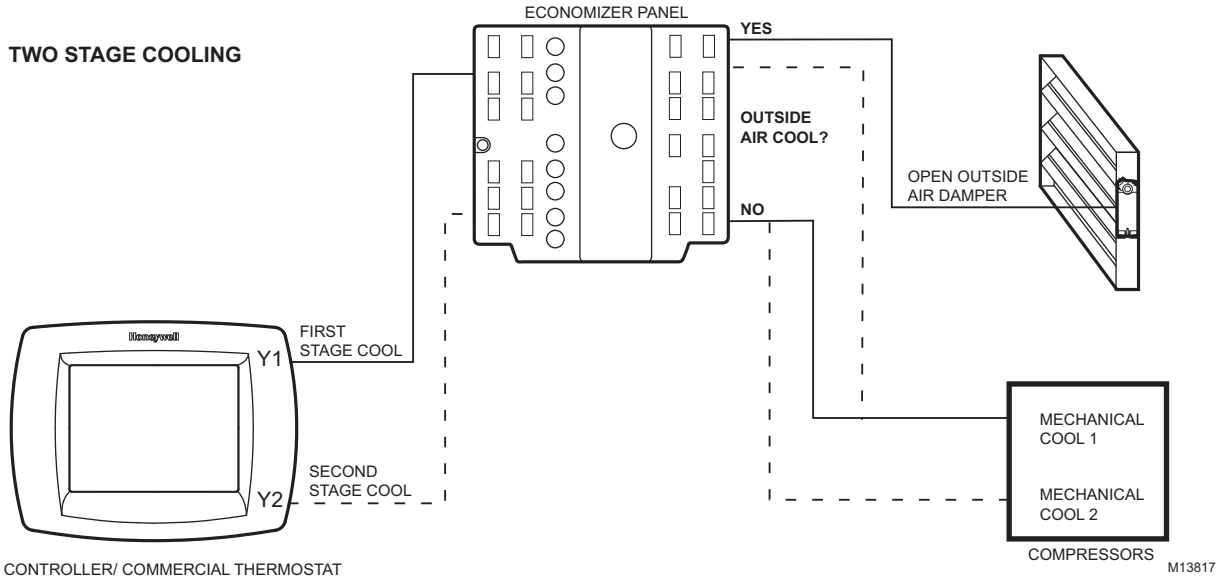
When the mixed or supply air goes below 50°F (10°C) the damper is modulated towards closed.

When the mixed or supply air goes above 56°F (13°C) the damper is modulated towards open.

IF THE OUTDOOR AIR IS NOT SUITABLE FOR FREE COOLING:

The first stage of the cooling compressor is turned on and the dampers are set to minimum for occupancy requirements (V_{at} if using DCV, V_{OT} if no DCV).

Single and Two Stage Cooling With Economizer



On a Call for Second Stage Cooling

Controller signal is routed to the economizer logic module.

IF THE OUTDOOR AIR IS SUITABLE FOR FREE COOLING AND THE OUTSIDE AIR DAMPERS ARE OPEN:

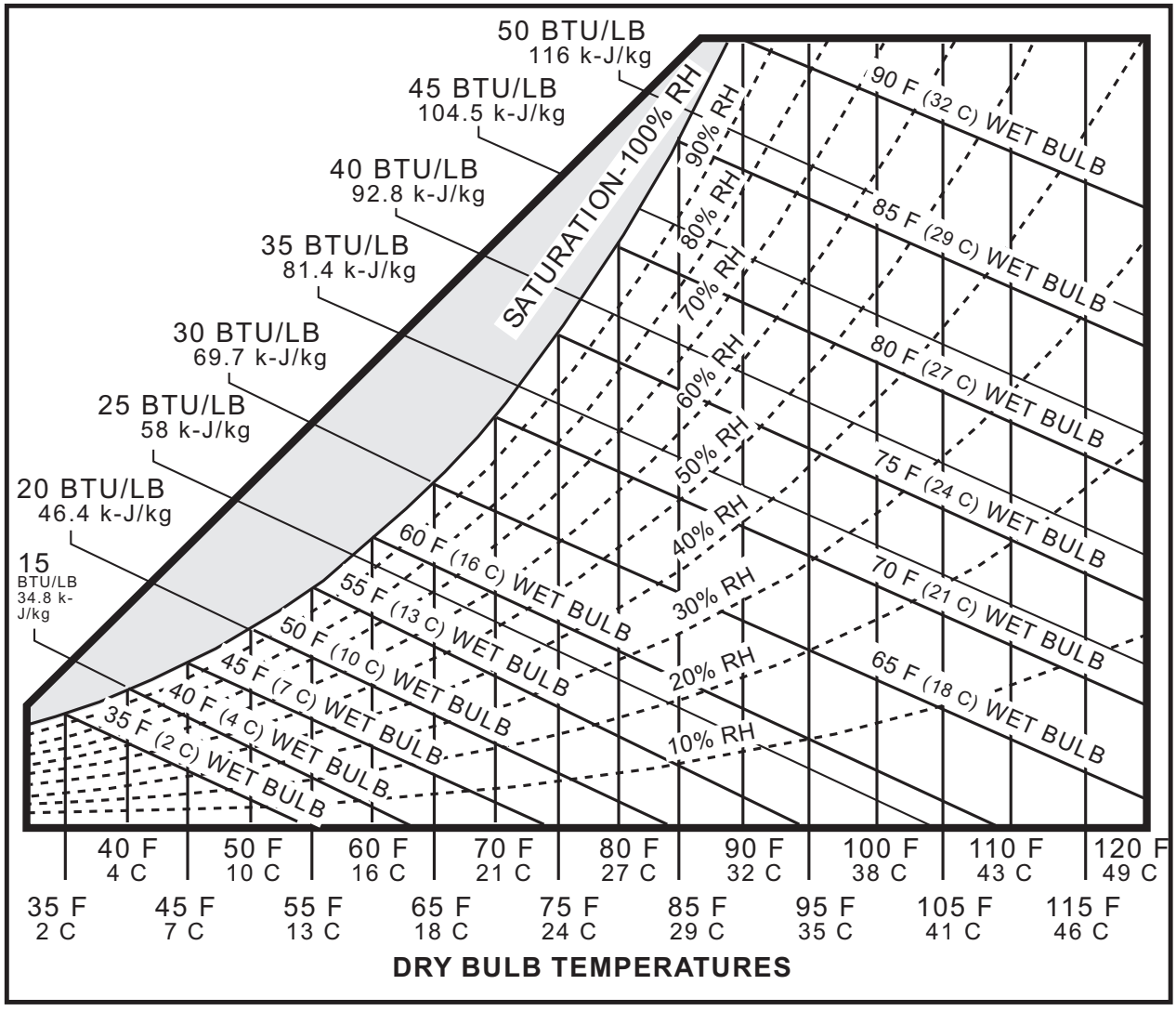
The economizer logic turns on the first stage of mechanical cooling for the second stage of cooling required by the commercial thermostat.

IF THE OUTDOOR AIR IS NOT SUITABLE FOR FREE COOLING:

The first stage cooling compressor is on, and the logic module turns on the second stage of mechanical cooling.

NOTE: A commercial thermostat with a minimum of two stages of cooling is required. The first stage must be available for economizing if outside air is suitable.

Section 2 - Enthalpy Theory And Controllers



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The Psychrometric Chart

This is a psychrometric chart. To use the chart effectively the thermodynamic properties of air must be known. Some common terms are:

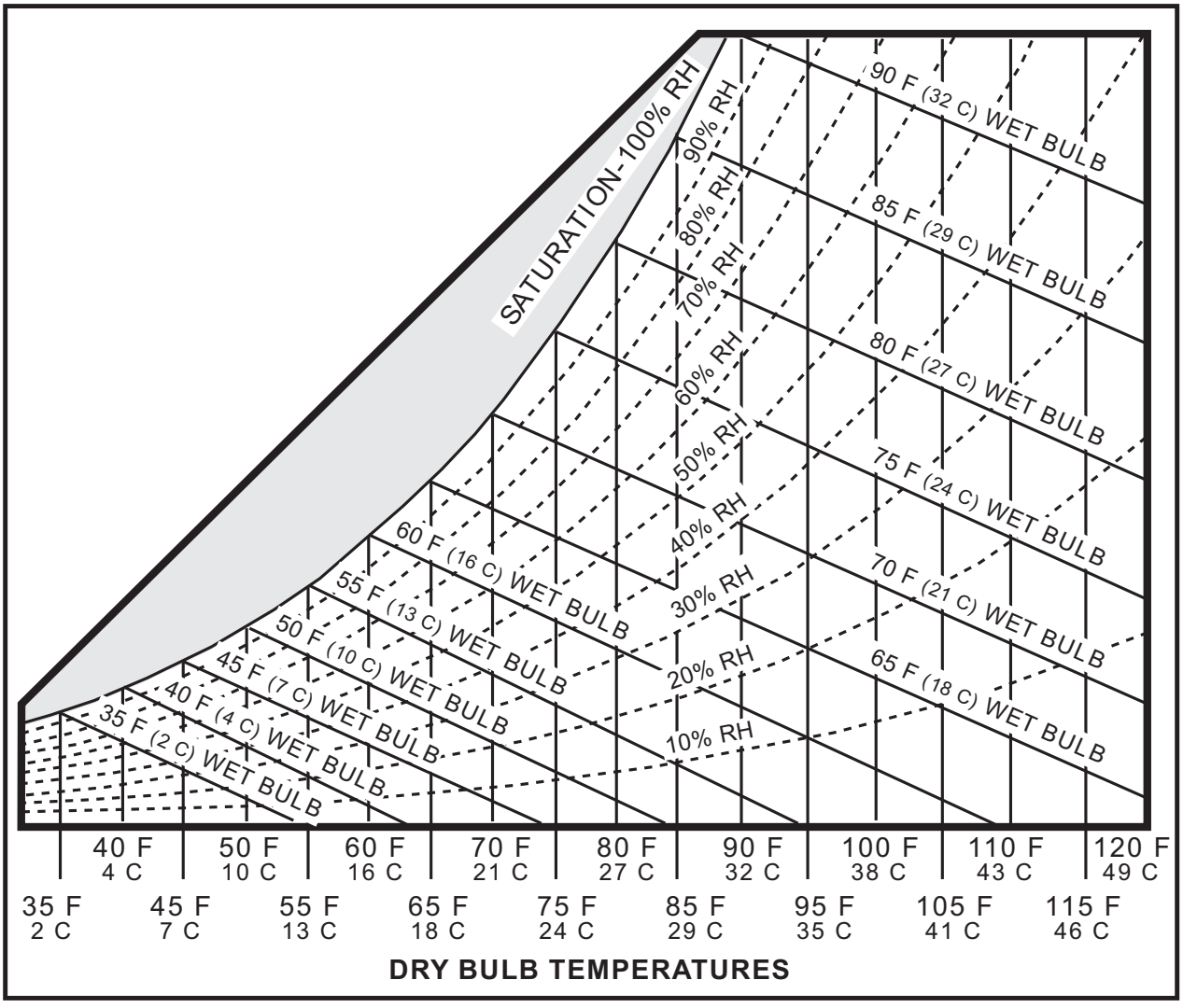
Dry Bulb Temperature

The temperature read directly on an ordinary thermometer.

Wet Bulb Temperature

The temperature read on a thermometer whose bulb is encased in a wet wick and with air blown across the wick at 900 ft. per minute (274 meters per minute). The evaporation of the water causes the temperature to drop, this may also be referred to as the “evaporation effect.” When the temperature stops falling that is the wet bulb temperature. The sling psychrometer is a common instrument used to determine the wet bulb temperature although there are other methods now available.

Dry bulb and wet bulb are the two most readily measurable variables on the chart and when known can be used to determine all other properties on the psychrometric chart.



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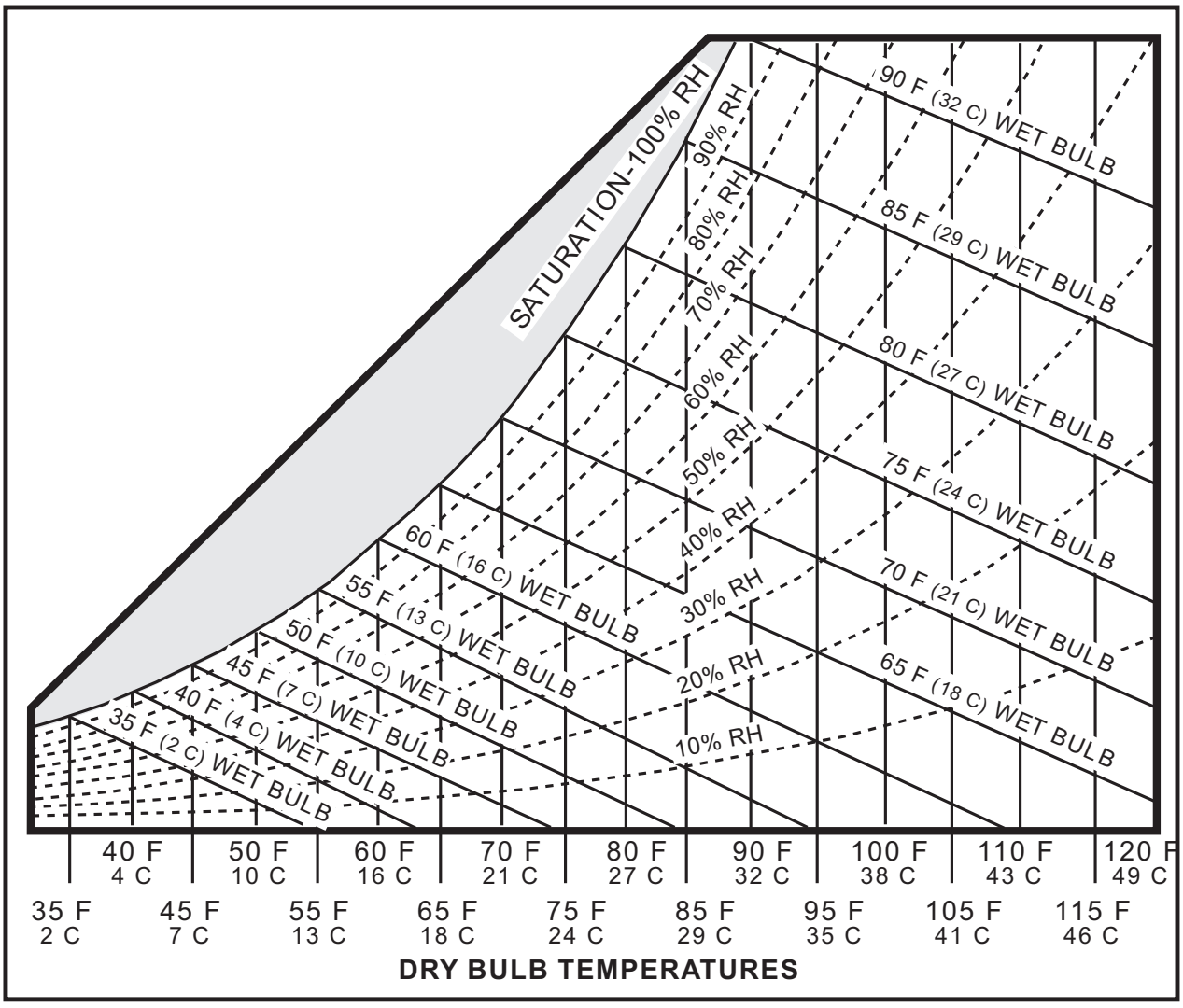
Relative Humidity and Saturation

Relative Humidity

Relative Humidity is the ratio of the measured amount of moisture in the air to the maximum amount of moisture the air can hold at the same temperature and pressure. Relative humidity is expressed in percent of saturation. Air with a relative humidity of 35%, for example, is holding 35 percent of the moisture that it is capable of holding at that temperature and pressure.

Saturation

The point at which the relative humidity reaches 100% and no more moisture can be contained in the air is the saturation point. The relative humidity and saturation lines are the only curved lines on this psychrometric chart.



M25279

Enthalpy

The measure of heat used in the United States today is the British Thermal Unit or BTU. This is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. A metric unit is the joule. There are 1055 joules per BTU.

Sensible Heat

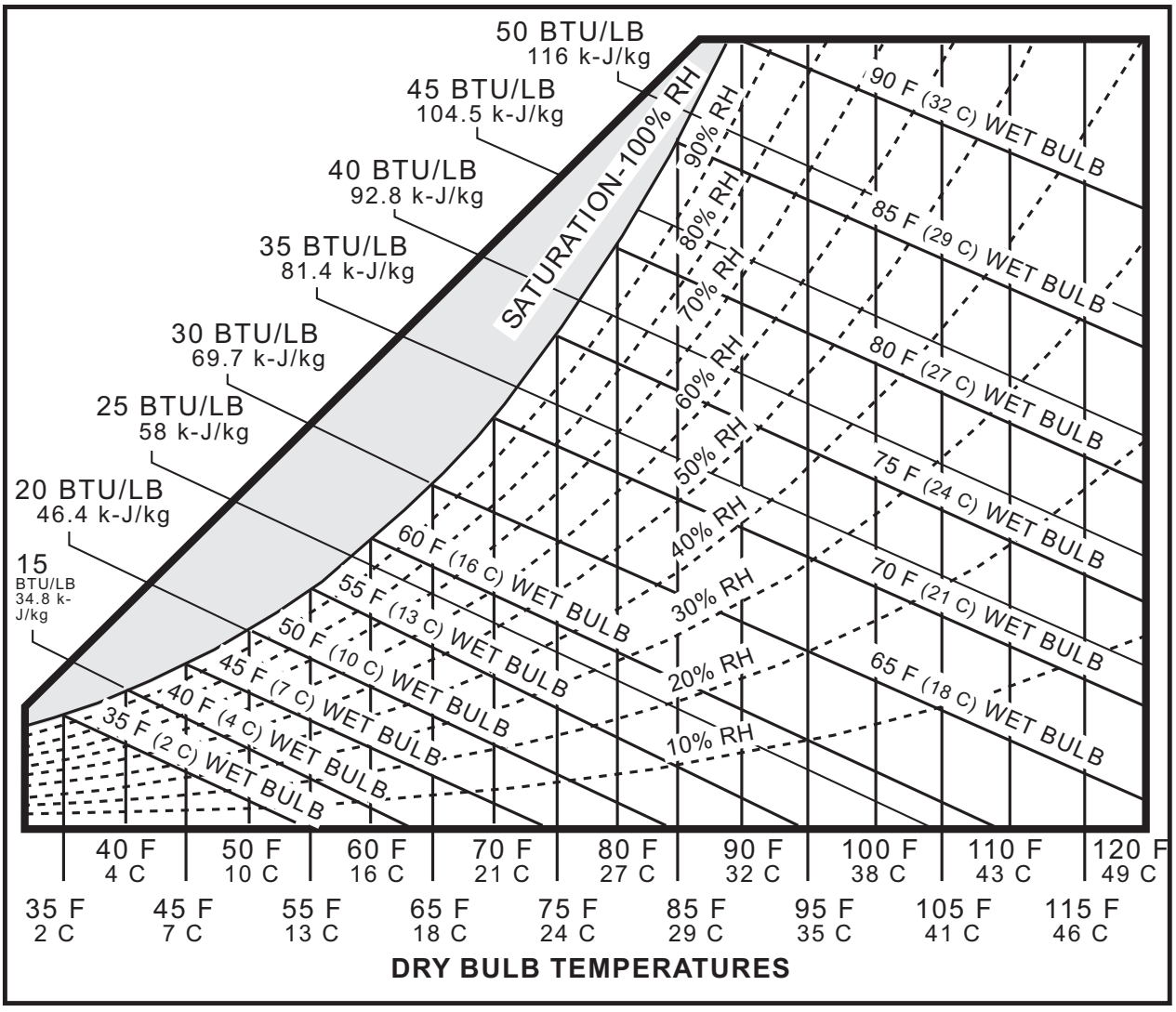
Heat that changes the temperature of the air without changing its moisture content or dew point temperature is sensible heat. Heat added by a heating coil is sensible heat. Heat removed by a cooling coil that remains dry is also sensible heat.

Latent Heat

Heat required to change water to vapor (steam) without change in temperature or pressure is latent heat. It is also called heat of vaporization. When water is vaporized the latent heat passes into the air, and when vapor condenses, latent heat is removed.

Total Heat (Enthalpy)

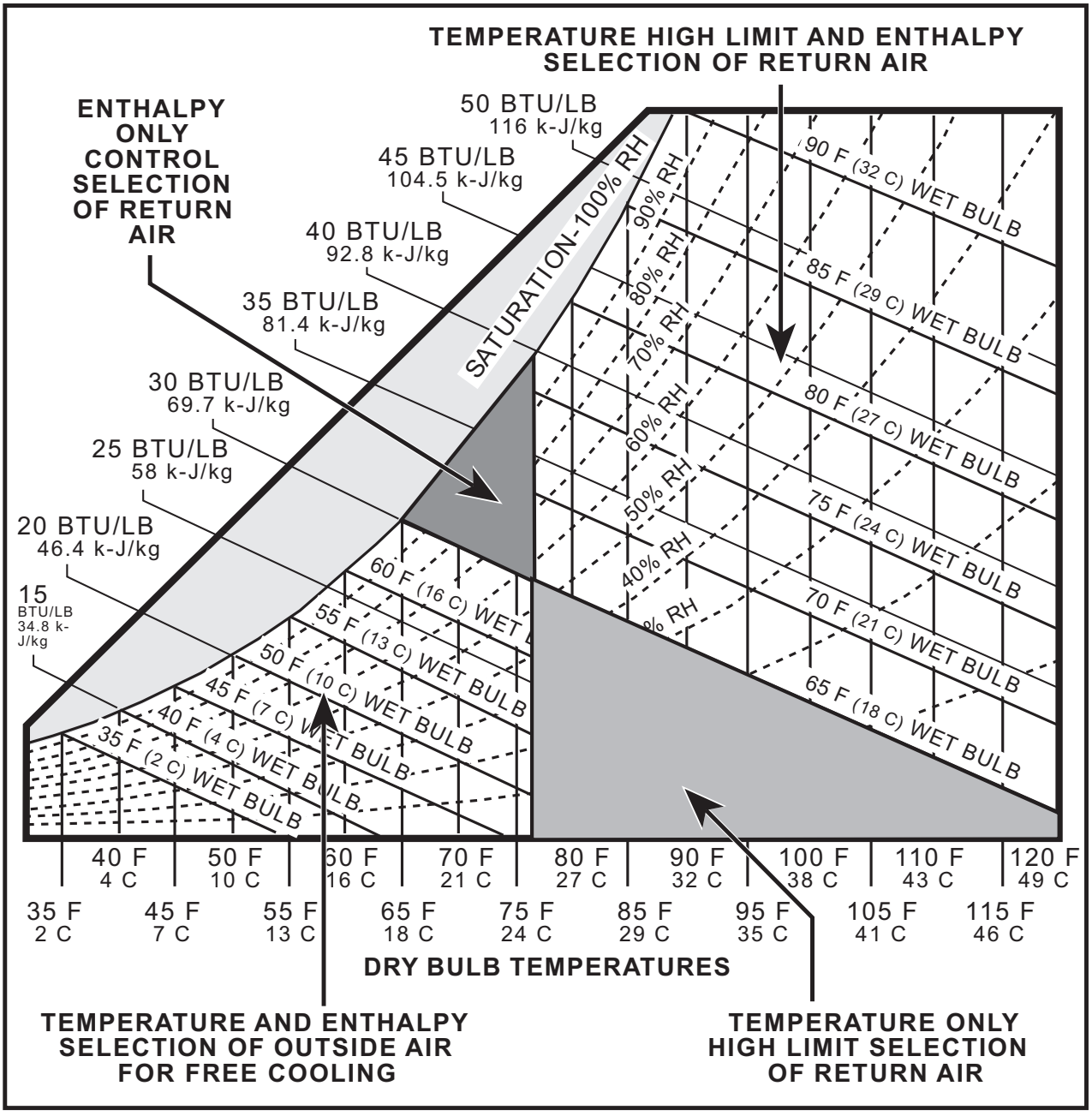
The sum of sensible and latent heat and is commonly referred to as enthalpy. Enthalpy is often referred to as the total heat content of the air.



M25280

Psychrometric Chart of Enthalpy Economizer Control

A standard dry bulb economizer discussed earlier causes the air handler to switch over from outside air to return air at the setpoint of the outside air high limit. This will typically be 75 or 76°F. (24°C). Dry bulb economizers only control the outside air dampers based on temperature. If it is a cool but rainy day, the outside air will be brought in and extra cooling capacity will be required to dehumidify it. Enthalpy economizers take temperature and humidity into account. With enthalpy control, humid air below a conventional dry bulb temperature setpoint is locked out. Cooling costs are lowered in most climates when using enthalpy instead of dry bulb temperature with the economizer.

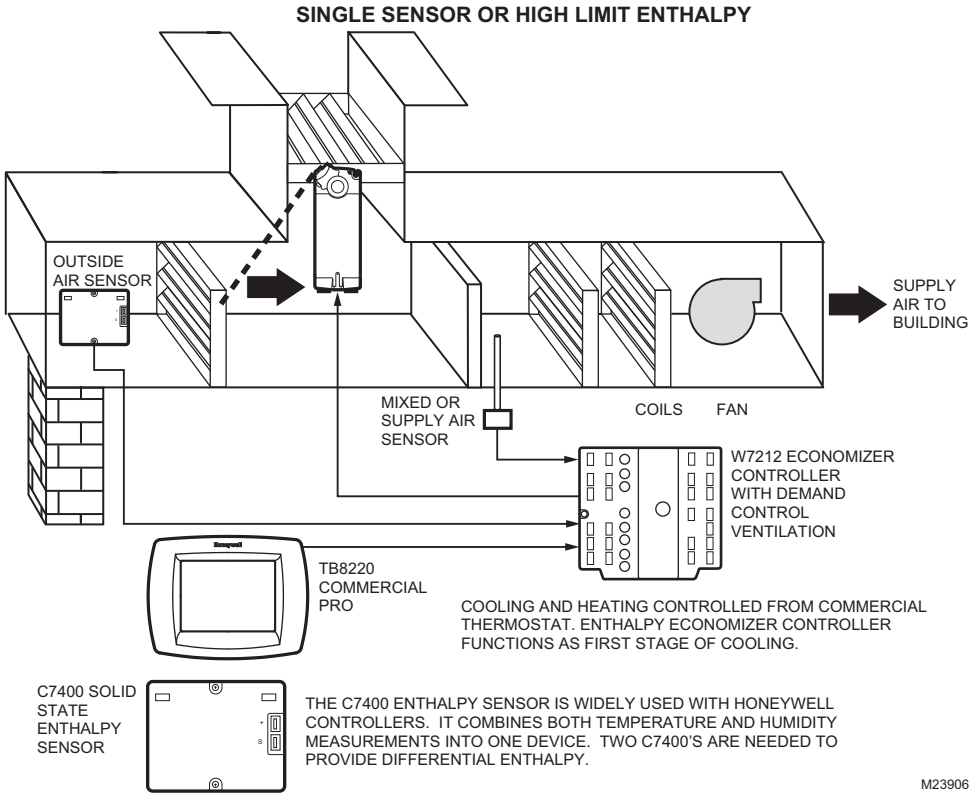


M25281

Single Sensor Enthalpy Control

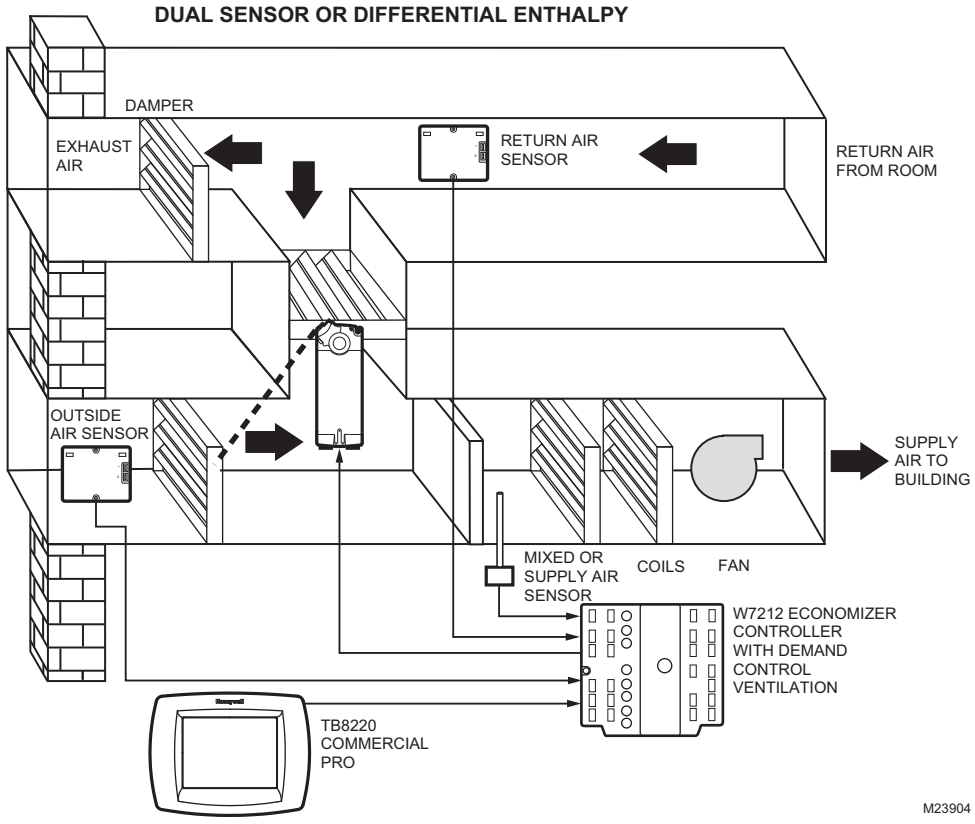
There are two enthalpy control strategies available: single and differential enthalpy control.

The single enthalpy control uses one enthalpy sensor located in the outdoor air in any orientation that exposes it to freely circulating air and protects it from rain, snow and direct sunlight. The enthalpy sensor replaces the dry bulb high limit used in a standard economizer. Instead of switching the mixed air control loop from outdoor to return air at a preset outdoor air dry bulb temperature, on a call for cooling from the controller or commercial thermostat the economizer logic module compares the outdoor enthalpy to a preselected setpoint. The value of the setpoint is illustrated on the psychrometric chart on page 55 with curves labeled as A, B, C or D. The setpoint selected will vary based on climate, activities in the controlled area and the type of mechanical equipment used to provide cooling. An installer can choose a more aggressive setpoint A for more free cooling or a conservative setpoint D for less free cooling. The mixed air sensor, located in the area where the return and outdoor air mix, maintains the mixed air temperature between 50 and 56°F (10.0 and 12.8°C).



Two Sensor or Differential Enthalpy

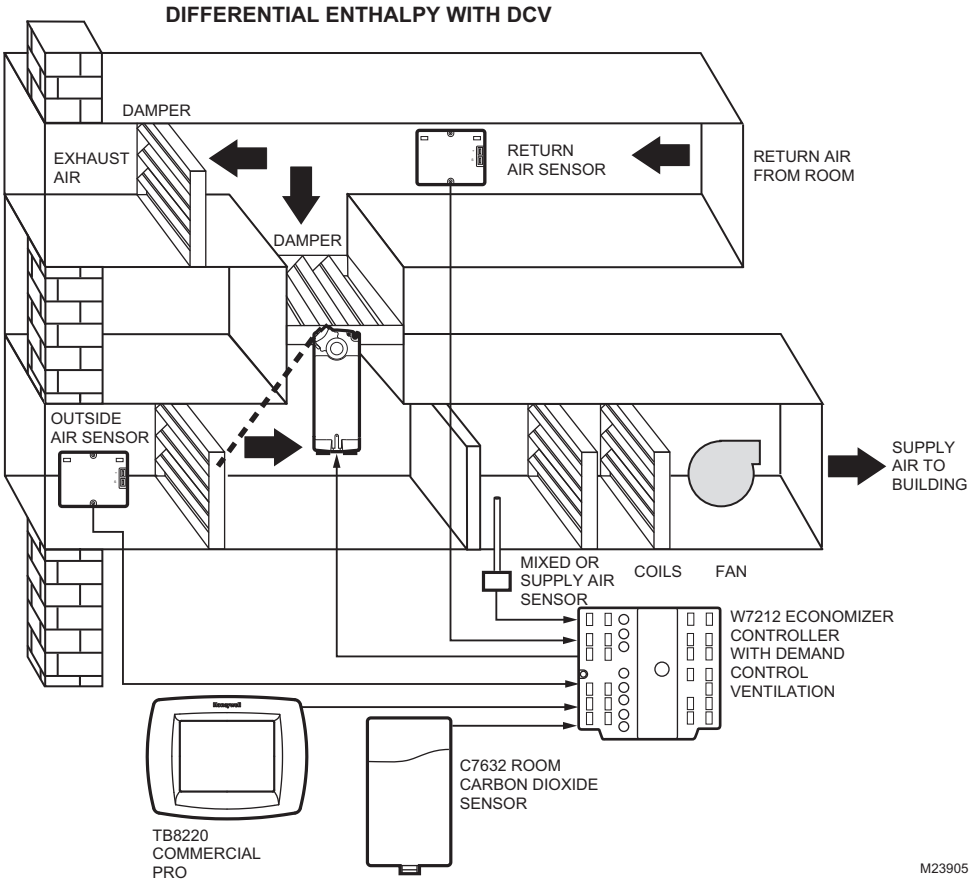
A dual sensor enthalpy control is equipped with the same outdoor air enthalpy sensor and an additional second enthalpy sensor in the return air. This is also referred to as differential enthalpy. On a call for cooling or when the mixed air temperature goes above 56°F, or there is a call for additional cooling from the commercial thermostat, the air with the lower enthalpy, outdoor or return, is selected to be brought into the conditioning section of the air handler. The setpoint on the logic module is turned to D whenever differential enthalpy is used. This is a very efficient method of controlling outdoor air usage since the return and outside air comparison is continuous and automatic year-round. It eliminates operator error by eliminating seasonal changeover which is frequently overlooked. Though it may appear wasteful to cool outdoor air at a higher dry bulb temperature than return air, the savings are verifiable through psychrometric calculations. The amount of mechanical cooling required to dehumidify air often exceeds the amount required to lower the dry bulb temperature. In buildings where there is a substantial amount of cooking, laundry or other moisture generating activity this type of control sequence can result in substantial savings in cooling costs.



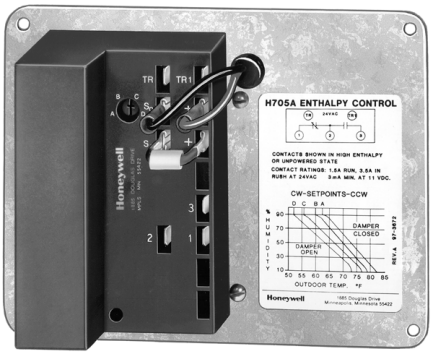
Enthalpy Control with Carbon Dioxide Sensor

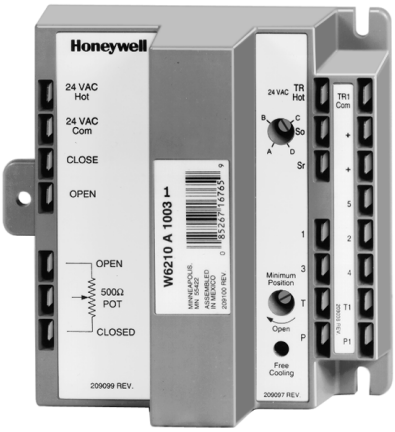
Most building codes allow for the option of carbon dioxide sensor-based demand control ventilation (DCV) to determine the human occupancy level of the space. Honeywell supplies controllers that combine this function with the economizer function. They are the W7212, W7340, W7460, and the W7215 economizer logic modules. All of these logic modules have inputs for a room indoor air content sensor. Additionally the W7215B is available with outdoor air content sensor inputs. The W7215 and W7212 are designed to be used with series 72 actuators and the W7460 with the M7415 actuator. The W7340 is designed to be used with an OEM system because it requires external relays to switch to compressor and communicates with the OEM system controller via a modified modbus protocol. In addition to the indoor sensor based demand control ventilation option, these logic modules have additional features including:

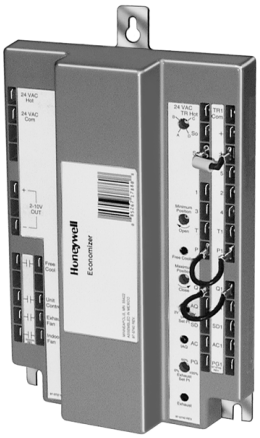
- Maximum damper position adjustment (DCV max).
- Exhaust fan setpoint.
- Occupied and Unoccupied operation.
- W7213 and W7214 are heat pump models.



Section 3 - Types of Economizers

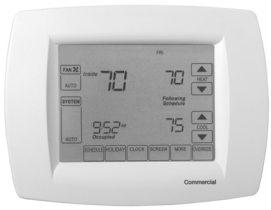






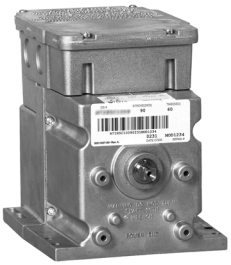
There are six types of Honeywell enthalpy economizer modules. All can be single or differential enthalpy. Some can be used for differential temperature with C7650 dry bulb sensors. They vary based on the actuator control series, mixed air circuitry and enthalpy sensor configuration.

Section 3—H705



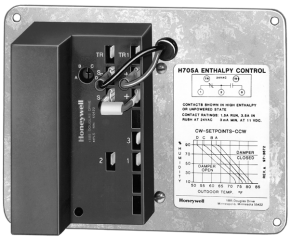
Commercial thermostat

Separate Series 70 or 90 mixed air controller



Mod IV actuator

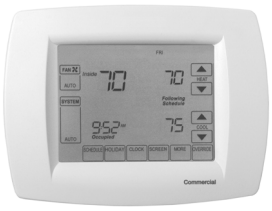
Optional second enthalpy sensor



H705 on plate, one enthalpy sensor on back

The H705 is the base controller since the mixed air circuitry is not included. Its function is to provide SPDT high limit switching in a separate mixed air control circuit, typically series 90. It replaces the H205 without substantial wiring modifications. It can also be used in control circuits with other company's devices if a SPDT economizer high limit is applicable.

Section 4—W7459



Commercial thermostat

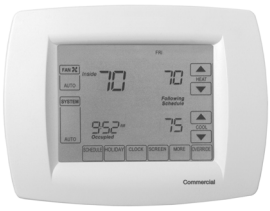
M7405, M7415 or M8405 actuators only

One enthalpy or dry bulb and one mixed/supply air sensor required. Second enthalpy sensor optional.

W7459 install on actuator

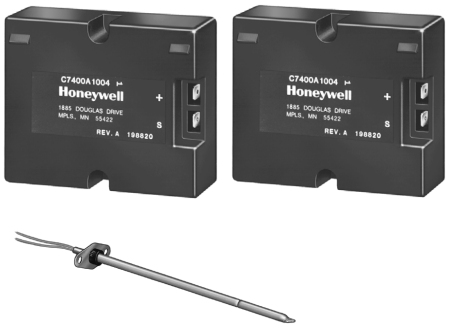
The W7459 is similar to the H705 in that only the enthalpy high limit function is provided and the mixed air control circuit is in the actuator. This restricts W7459 use to the M7415, M7405 and M8405 actuators and it installs directly onto them. Unlike the H705 there is not a sensor built into the W7459 so wiring connections are required for one or two enthalpy sensors. It is available for use with direct digital (W7459B), SPDT mixed air controllers (W7459C) or as a stand-alone mixed air controller with a mixed air sensor (W7459A or D).

Section 5—W6210 and W7210

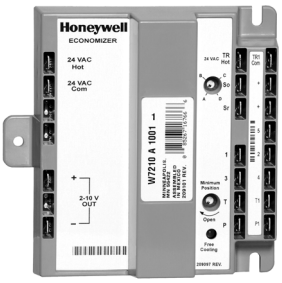


Commercial thermostat

Series 62 or 72 Actuator



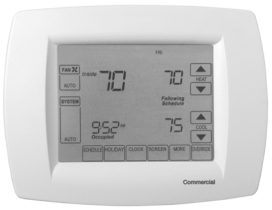
One enthalpy or dry bulb and one mixed/supply air sensor required. Second enthalpy sensor optional.



W6210, W7210 install on flat surface

The W6210 and W7210 are for use with Honeywell series 62 or 72 actuators. The W6210 is no longer available for new installations, replacement modules may still be available. The mixed air control circuitry that was either separate or included in the actuator in the H705 or W7459 modules is included in these economizers. The options for enthalpy and mixed air sensors are the same as the W7459. The difference between the W7459 and the W7210 is the W7210 has the addition of the 2-10 Vdc out for controlling a series 70 DCA or foot-mounted motor, 24 Vac power and ground for the motor and the mixed air circuitry in the control. W6210 is used with floating series 62 motors.

Section 6—W6215, W7215 and W7460



Commercial thermostat

Series 62 or 72 or M7415 Actuator

One enthalpy or dry bulb and one mixed/supply air sensor required. Second enthalpy sensor optional.

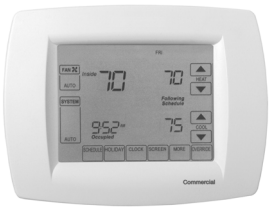
Optional room CO_2 sensor on A models, additional optional outdoor CO_2 sensors on B models.

W6215, W7215, W7460 install on flat surface

The W6215A, W7215A and W7460A economizer modules are similar to the W6210 and W7210 with the addition of inputs from a room indoor air content sensor for Demand Control Ventilation and contact inputs and outputs to monitor and control various devices. The indoor air content sensor typically will be a carbon dioxide (CO_2) sensor. The B models include inputs from an outdoor air content sensor for the function of limiting outdoor air usage when the air is not suitable for ventilation. The actuators used with these controllers are:

- W6215 - Series 62 (no longer available for new installations).
- W7215 - Series 72.
- W7460 - M7415.

Section 7—W7212, W7213 and W7214



Commercial thermostat

One enthalpy or dry bulb and one mixed/supply air sensor required. Second enthalpy sensor optional.

W7212, W7213 and W7214 install on flat surface or mount on M7215 motor.

Series 62 or 72 Direct Coupled Actuators or M7215 Actuator

Optional room CO_2 sensor on A models, additional optional outdoor CO_2 sensors on B models.

The W7212 DCV economizer logic module is the simplest Demand Control Ventilation economizer model. It combines all of the benefits of the W7459 and W7210 with the added features of the W7215. It does not include shutdown, air change and purge but does have a “N” terminal for night setback. On W7213 and W7214 models N terminal is either B or O terminal for use with heat pumps.

There are three models:

- W7212A- Used with series 70 actuators including DCA’s, M7215, and Modutrol Motors
- W7213A - Used with heat pumps or conventional rooftop units. B terminal energized in heating and unenergized in cooling
- W7214A - Used with heat pumps or conventional rooftop units. O terminal unenergized in heating and energized in cooling.

All models can be panel mounted or directly mounted to M7215 motor.

Section 8—W7340 and W7345

One enthalpy or dry bulb and one mixed/supply air sensor required. Second enthalpy sensor optional.

Optional room CO_2 sensor on W7340 models

W7340

W7345

W7340 and W7345 mount on flat surface or on a M7215 motor

The W7340 is a full enthalpy economizer used in an OEM unit to provide a totally integrated control system. The W7345 provides temperature (OAT) control only; it does not have an option for a return air sensor, DCV sensor or exhaust control.

The W7340A and B modules do not have the ability to set the outdoor air damper to a maximum position for DCV, it incorporates a minimum position setting that defaults to 20% but can be overridden using the on-board pot or Modbus communication link to a maximum of 50% open.

The maximum position sets the damper position to a position that the damper goes to if the CO_2 sensor fails. If the minimum position set point is higher than the DCV maximum position, on sensor failure, the damper goes to the higher of the two of DCV maximum and minimum position setting.

There is no limit on the damper position on a call from the CO_2 sensor (DCV). It can go 100% open, not complying with ASHRAE 62.1.

Table Listing of Economizer Modules without DCV

Motor Type	Motor	Logic Module	Sensors
Foot Mount 25 lb-in. Torque	M7415	W7459A,D	Enthalpy: C7400[a] with C7150/ C7046 Temperature: C7650 with C7150/ C7046
	M9175	H705 or W7210[b]	
DCA 44 lb-in. Torque	MS7505	W7210	
Foot Mount 60 lb-in. Torque	M7285, M7286	W7210	
	M9185, M9186	H705, W7210[b]	
DCA 88 lb-in. Torque	MS7510	W7210	
DCA 175 lb-in. Torque	MS7250	W7210	

[a] Enthalpy sensor, use two for differential enthalpy and one for single enthalpy. For Dry Bulb only, use C7650 instead.

[b] To operate a series 90 motor, the W7210, W7212, W7213, W7214 and W7215 require a Q7230 interface module or the proper resistor combination (included in the 4074EJM resistor kit), see form 63-2544 for details.

NOTE: Series 90 Modutrol Motors can be retrofit using W7210, W7212 and W7215 Economizer Logic modules and a Q7230 or the proper resistor combination. Refer to for 63-2544 for details on using Economizer Logic Modules with Series 90 motors.

Table Listing of Economizer Modules with DCV

Motor Type	Motor	Logic Module	Sensors
Foot Mount 25 lb-in. Torque	M7415	W7460	Enthalpy: C7400[a] with C7150/ C7046 Temperature: C7650 with C7150/ C7046 CO2: C7232 or C7632
	M7215	W7212/13/14	
	M9175	W7215[b], W7212[b], W7213/ 14[b]	
DCA 44 lb-in. Torque	MS7505	W7215, W7212, W7213/14	
Foot Mount 60 lb-in. Torque	M7285, M7286	W7215, W7212, W7213/14	
	M9185, M9186	W7215[b], W7212[b], W7213/ 14[b]	
DCA 88 lb-in. Torque	MS7510	W7215, W7212, W7213/14	
DCA 175 lb-in. Torque	MS7250	W7215, W7212, W7213/14	

[a] Enthalpy sensor, use two for differential enthalpy and one for single enthalpy. For Dry Bulb only, use C7650 instead.

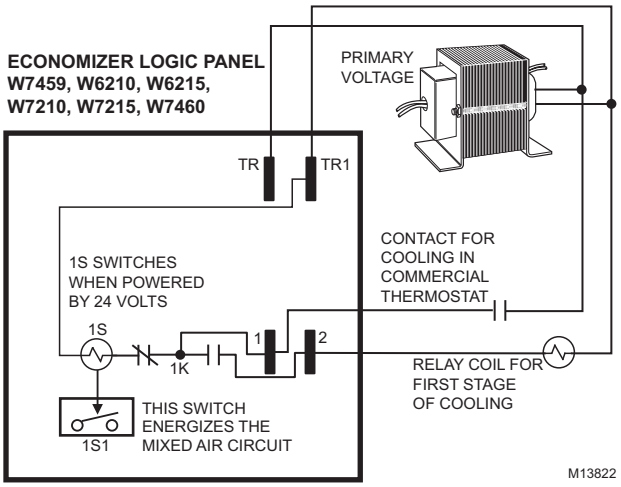
[b] To operate a series 90 motor, the W7210, W7212, W7213, W7214 and W7215 require a Q7230 interface module or the proper resistor combination (included in the 4074EJM resistor kit), see form 63-2544 for details.

NOTE: Series 90 Modutrol Motors can be retrofit using W7210, W7212 and W7215 Economizer Logic modules and a Q7230 or the proper resistor combination. Refer to for 63-2544 for details on using Economizer Logic Modules with Series 90 motors.

Enhanced Economizer Features

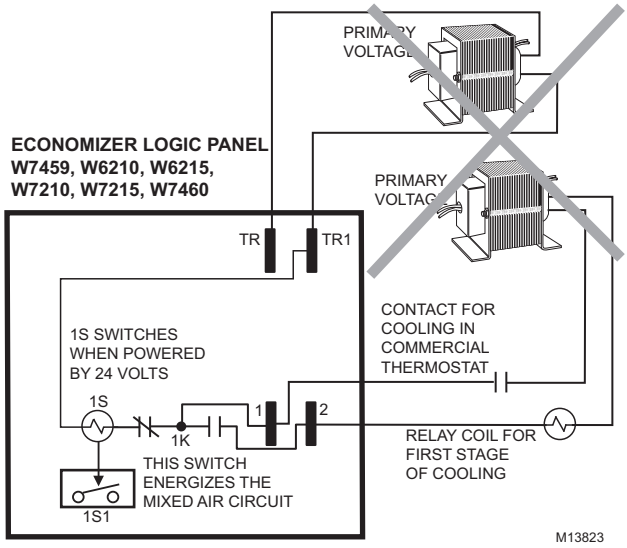
Economizer Module Series	Enthalpy High Limit	DCV Sensor (Indoor)	OAQ Sensor (Outdoor)	Exhaust Fan Setpoint	Shutdown and Air Change	Purge	Motors Controlled	Specific Product Number
H705							Series 90	H705A1003
							Series 90	H705A2001
							Series 90	H705D1001
W7459							M7405	W7459B1009
							M8405	W7459C1007
							M7415	M7459A1001
	YES						M7415	W7459D1005
W6210							Series 62	W6210A1003
	YES						Series 62	W6210D1007
W7210							Series 72	W7210A1001
	YES						Series 72	W7210D1005
W6215		YES		Adjustable	YES	YES	Series 62	W6215A 008
W7215		YES		Adjustable	YES	YES	Series 72	W7215A1006
		YES	YES	Fixed	YES		Series 72	W7215B1004
W7460		YES		Adjustable	YES	YES	M7415	W7460A1008
		YES	YES	Fixed	YES		M7415	W7460B1006
W7212		YES		Adjustable			Series 72	W7212A1009
W7340		YES		Modbus			Series 72	W7340C1000
W7345		YES					Series 72	W7345B1001

Transformer Wiring Requirements for Economizers



Economizer Panel Supplied With Same Transformer As Cooling Commercial Thermostat.

One of the most common misapplications of economizers is related to the field wiring. When the problem is the economizer will not open the dampers and it is really cool outside, check the wiring with the transformers. Relay coil 1S is used to open the outside air dampers as the first stage of free cooling. To function properly 1S must be wired to both sides of the same transformer. When the same transformer is used for supplying the commercial thermostat, cooling relay and the economizer logic module the switching occurs correctly.



Economizer Panel Supplied With Separate Transformer From Cooling Commercial Thermostat.

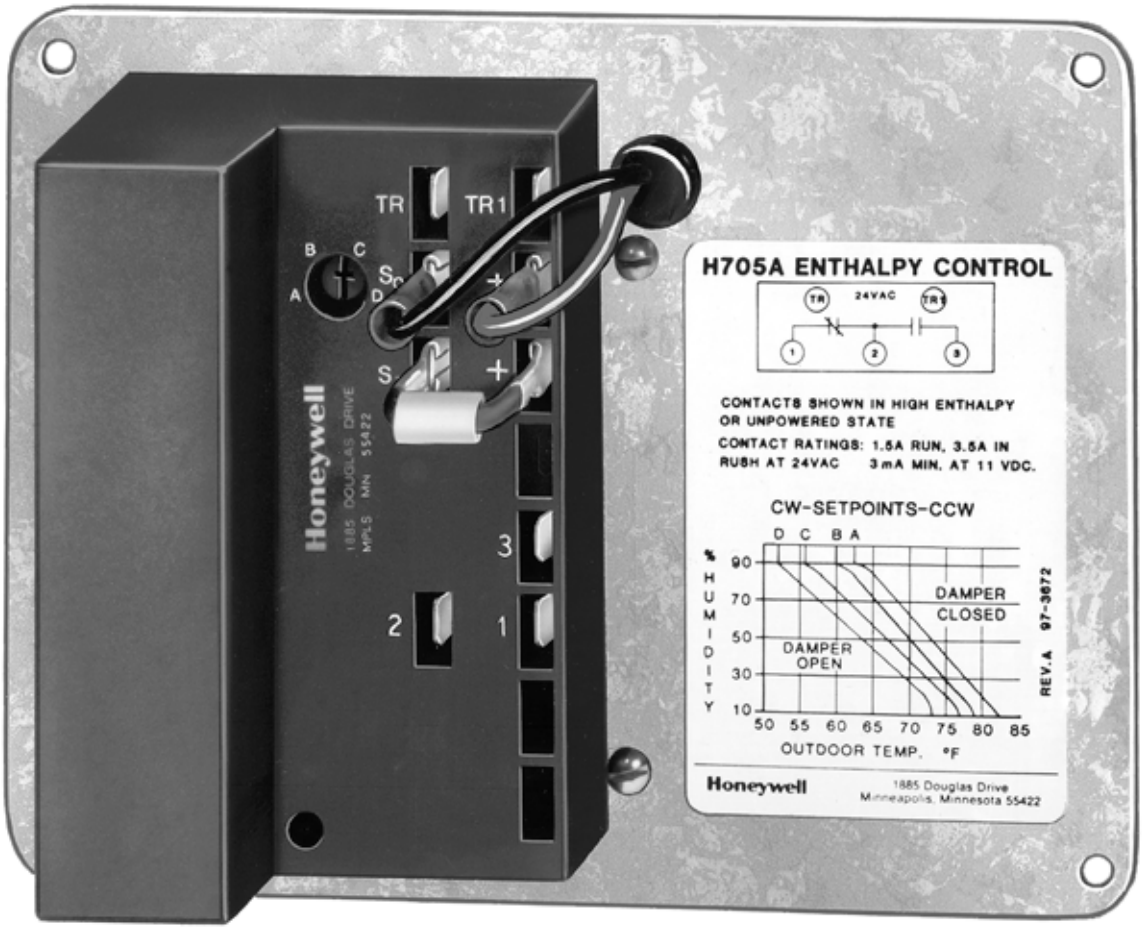
24 Vac is supplied to the relay coil 1S in this application from two separate transformers. Though the first stage of cooling will switch correctly through the economizer module circuit, the relay coil 1S may not. Honeywell recommends use of a single, larger transformer for both the economizer logic module and the cooling commercial thermostat circuit.

When wiring any economizer it is very important that you read the notes on the correct wiring diagram. The wiring diagrams normally show the internal connections of the logic module to help guide you if you are concerned with the common side of the transformers.

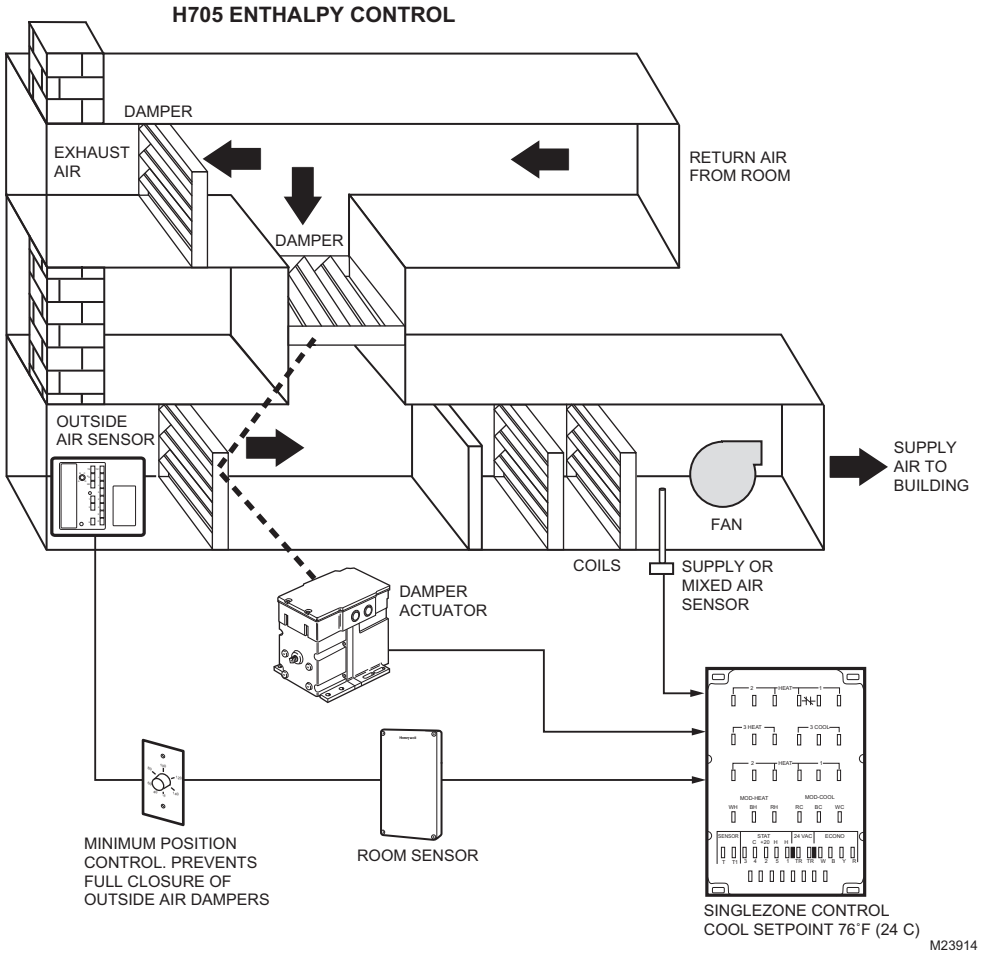
A rule of thumb to follow any Honeywell electronic economizer logic module will have all terminals ending with a 1 as ground.

With power supply provide a disconnect means and overload protection. Ensure the equipment transformer is sized to handle the extra load of the economizer, actuator and sensors.

Section 4 - H705 Economizer Module

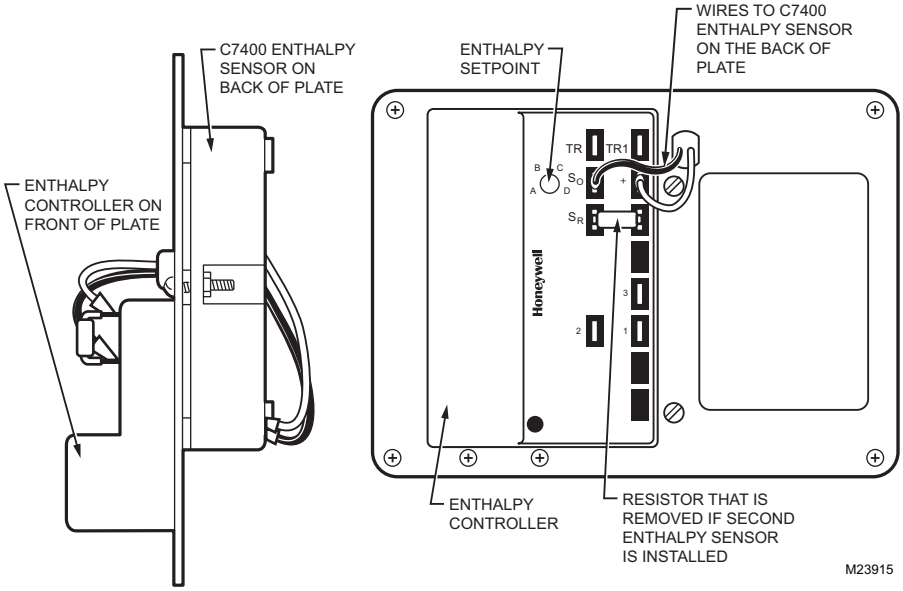


H705 Economizer Module



The H705 was the first Honeywell series of electronic economizer controllers. Prior to the development of the H705, an electromechanical device with a nylon humidity element, the H205, was the state-of-the-art controller. The H705 is a direct replacement for the H205. The output is the same SPDT switch which is typically wired into the mixed air circuit. The H705 can be installed in the same location in the air handler as the H205 and includes all the sensors required for single sensor enthalpy. It can be converted to differential enthalpy with the addition of a C7400 sensor in the return air. The H705 can be used for single or differential enthalpy in any economizer control circuit that is equipped with separate mixed air controls and is adaptable to a SPDT limit. This includes many economizer control devices made by companies other than Honeywell.

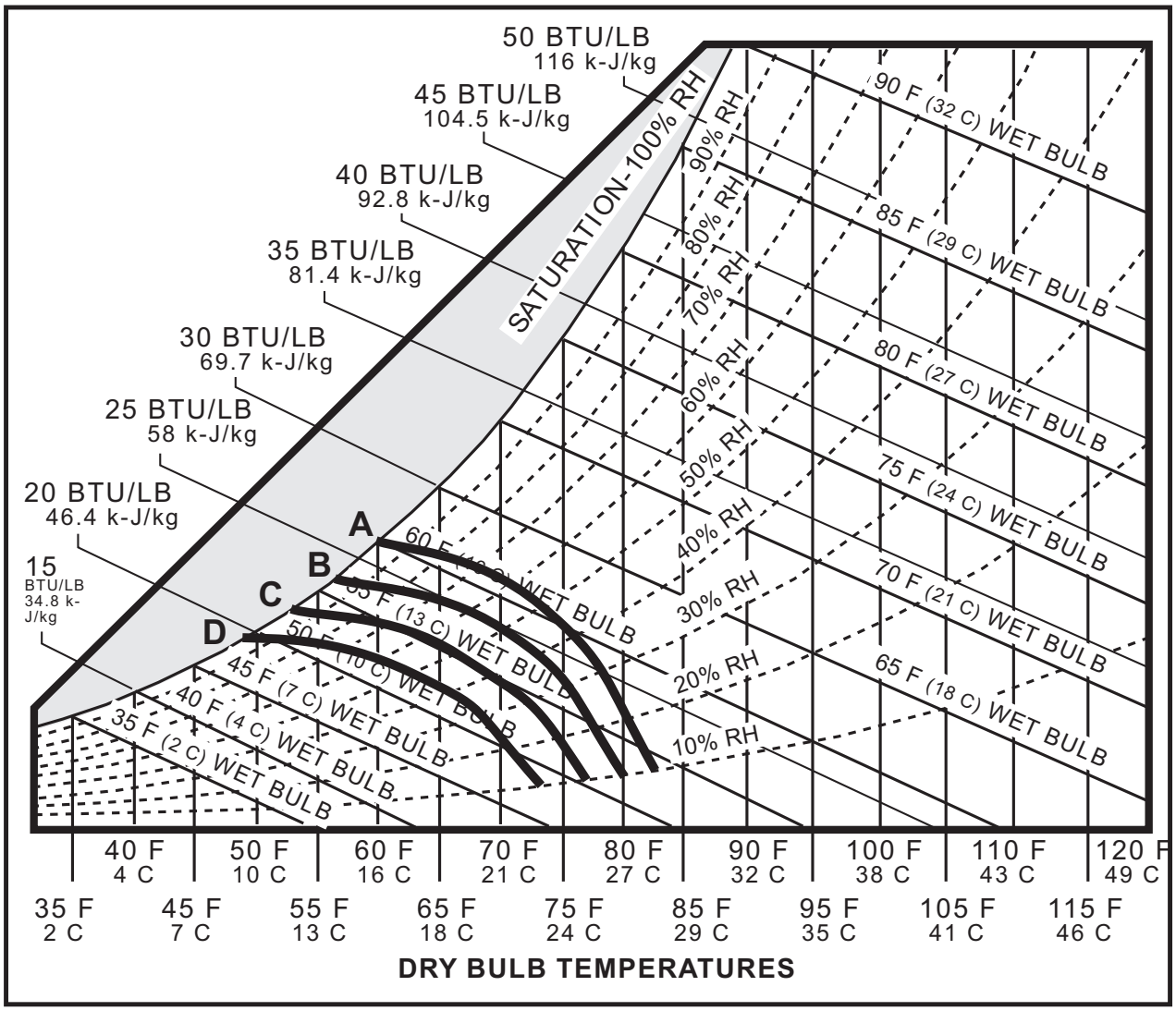
H705 Components



The H705A Enthalpy Controller provides solid state enthalpy changeover. The base configuration is single sensor enthalpy controller but it can be used for differential enthalpy. It is constructed of two devices: there is a solid state C7400 enthalpy sensor on one side of a metal plate and an enthalpy control on the other side. The device must be located in the outside air stream with a recommended minimum velocity of 500 feet per minute (152 meters per minute). The setpoint scale is A, B, C and D. Each setting corresponds to an enthalpy curve with A equalling the highest enthalpy changeover and D being the lowest enthalpy changeover. The output of this control is a SPDT relay output which can be used to switch the mixed air dampers from return to outside air and back as required for maximum efficiency.

There is a connection for an additional return air enthalpy sensor for differential enthalpy control. If this option is not used a 620 ohm resistor is installed across the S_R and + terminals.

H705 Enthalpy Setpoint



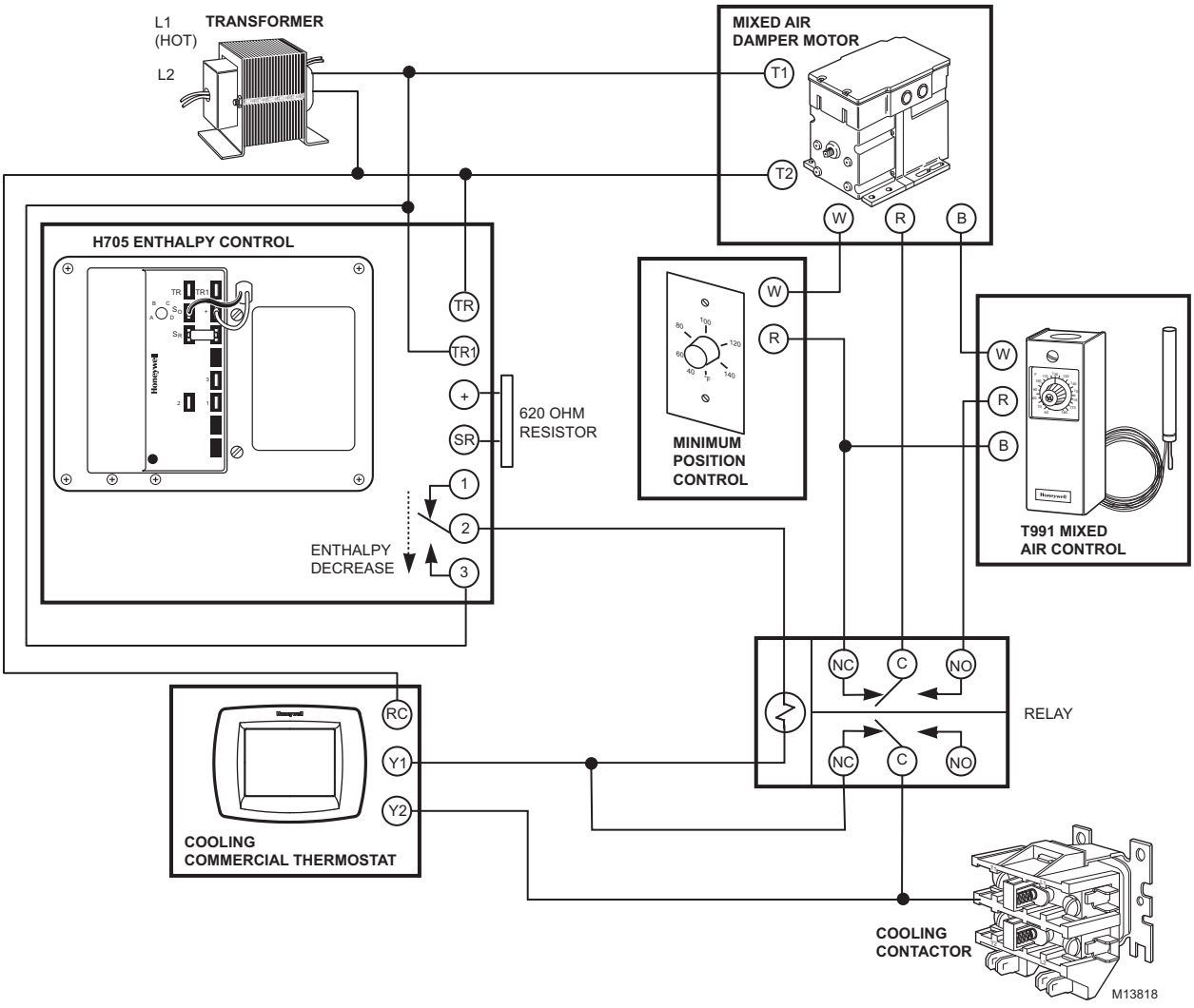
M25282

This psychrometric chart shows effects of the various economizer logic setpoints listed. This only applies to single enthalpy controllers not differential enthalpy. Air with conditions to the left of the curve is brought in from outdoors to be used for cooling. When the outdoor air conditions are to the right of the curve, the dampers will be set at minimum position and the mechanical cooling will be energized. For differential enthalpy the setpoint knob is turned to the D setting and the lower of return or outside air is brought into the building.

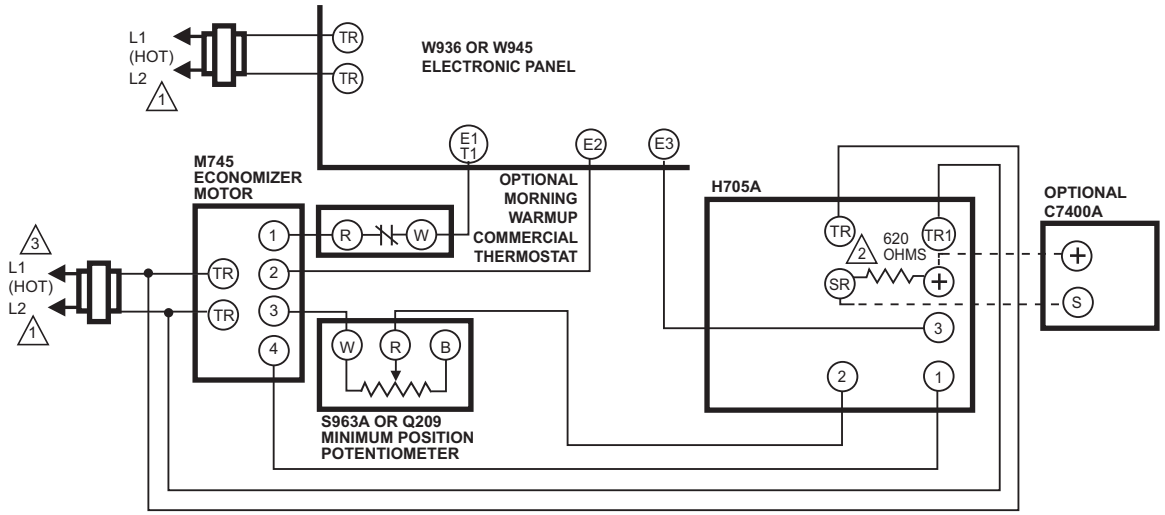
Example: With A, B, C, D potentiometer logic module set at “C”. Dry bulb temperature at 65°F (18.3°C) and Relative Humidity (RH) at 50% RH the logic module would free cool on first call for cooling for commercial thermostat.

Control Curve	Control Point (Approximate Temperature at 50% Humidity)
A	73°F (23°C)
B	70°F (21°C)
C	67°F (19°C)
D	63°F (17°C)
Knob turned to D	For Differential Enthalpy (2 Sensor)

H705 Wiring Diagram



The H705 enthalpy control is being used in this application in place of a dry bulb temperature economizer high limit. The H705 includes a single enthalpy sensor and is installed in the outside air. An optional second C7400 installed in the return air is used for differential enthalpy. If the second C7400 sensor is not used a 620 ohm resistor is installed across the S_R and + terminals and the H705 compares the outdoor enthalpy to a setpoint (A, B, C or D). The economizer modulates the outdoor dampers for free cooling provided the outside air enthalpy is below the setpoint on the H705. If the outdoor enthalpy is above the setpoint the outside air dampers are closed to a minimum position and the mechanical cooling is energized.



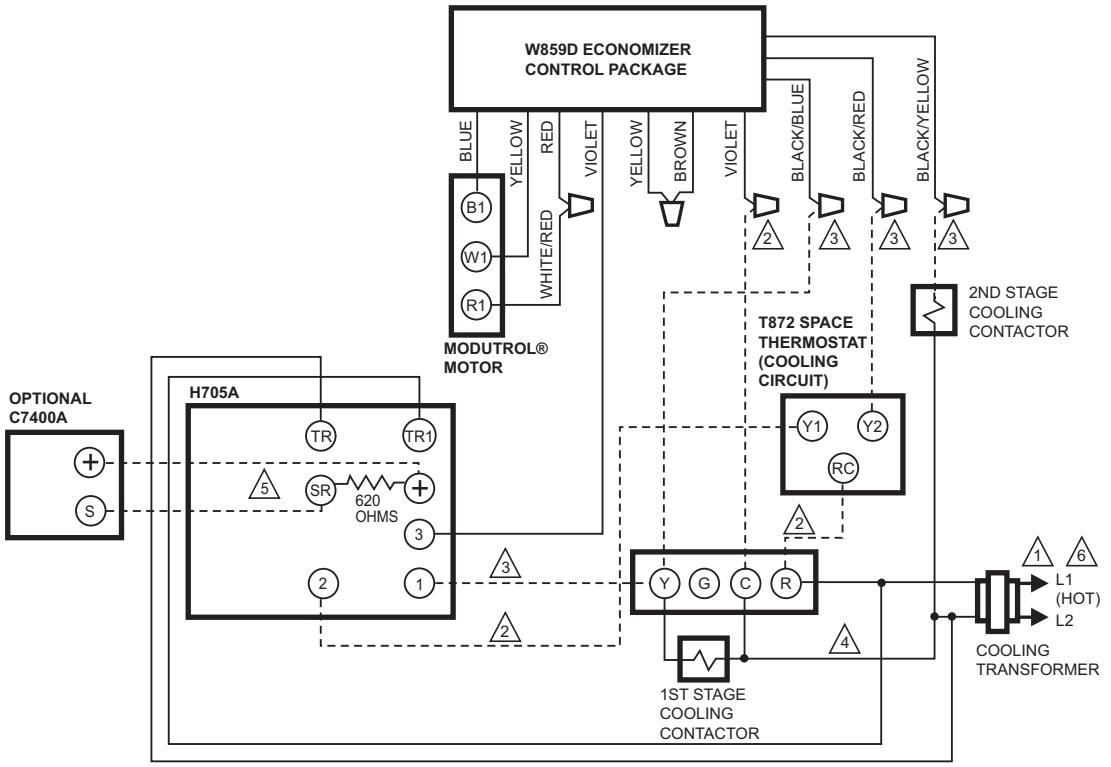
1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400A SENSOR IS ADDED TO SR AND + FOR DIFFERENTIAL ENTHALPY.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

M15037A

H705A used in electronic system



1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 FIELD CONTROL WIRING REQUIRED TO INTEGRATE ECONOMIZER INTO UNIT.

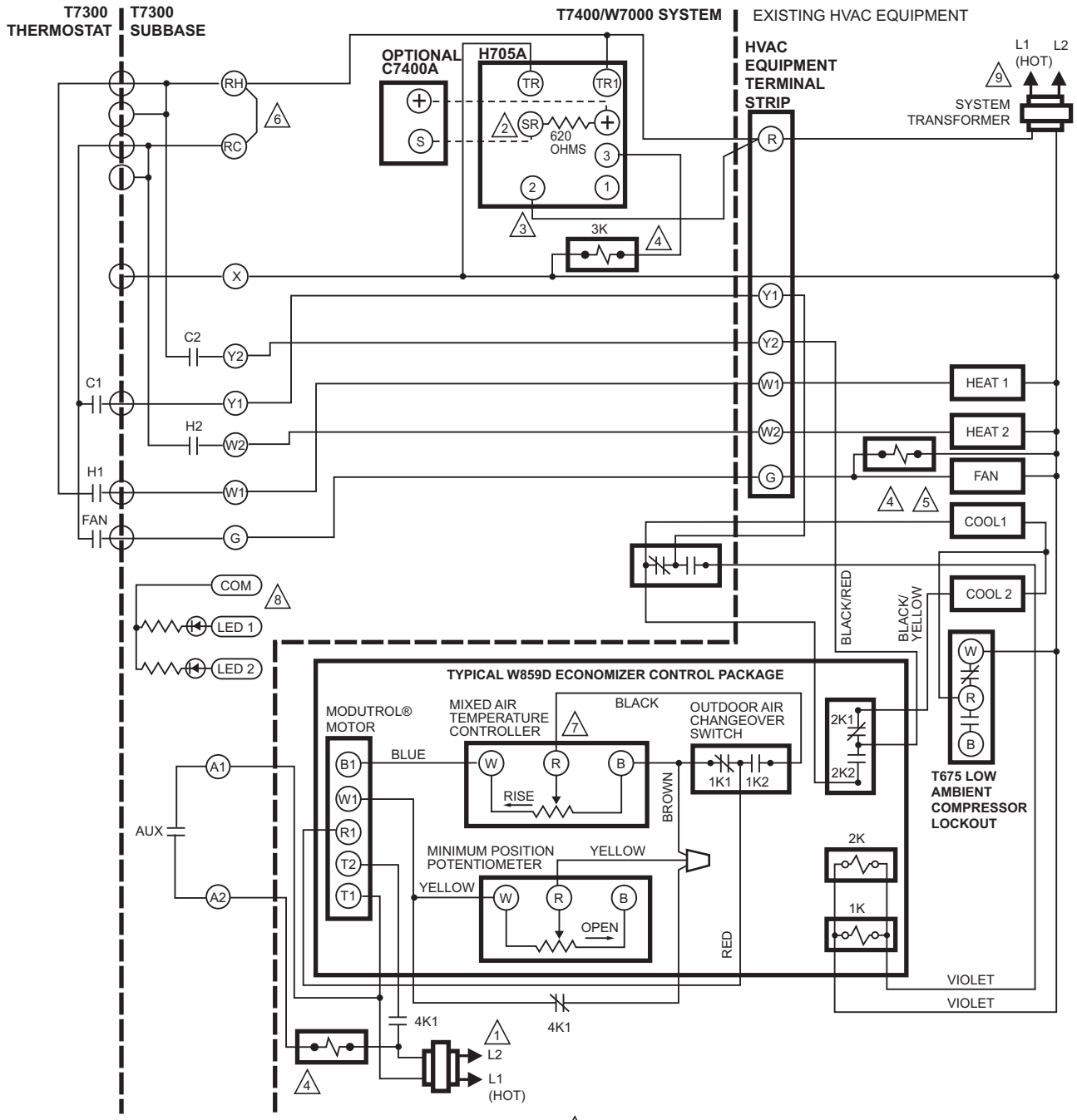
3 FIELD WIRING REQUIRED TO PROVIDE ECONOMIZER AND MECHANICAL COOLING OPERATION IN EXISTING INSTALLATION.

4 ROOFTOP TERMINAL STRIP IS PART OF AIR CONDITIONING UNIT.

5 FACTORY-INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400A SENSOR IS ADDED TO SR AND + FOR DIFFERENTIAL ENTHALPY.

6 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR. M12162

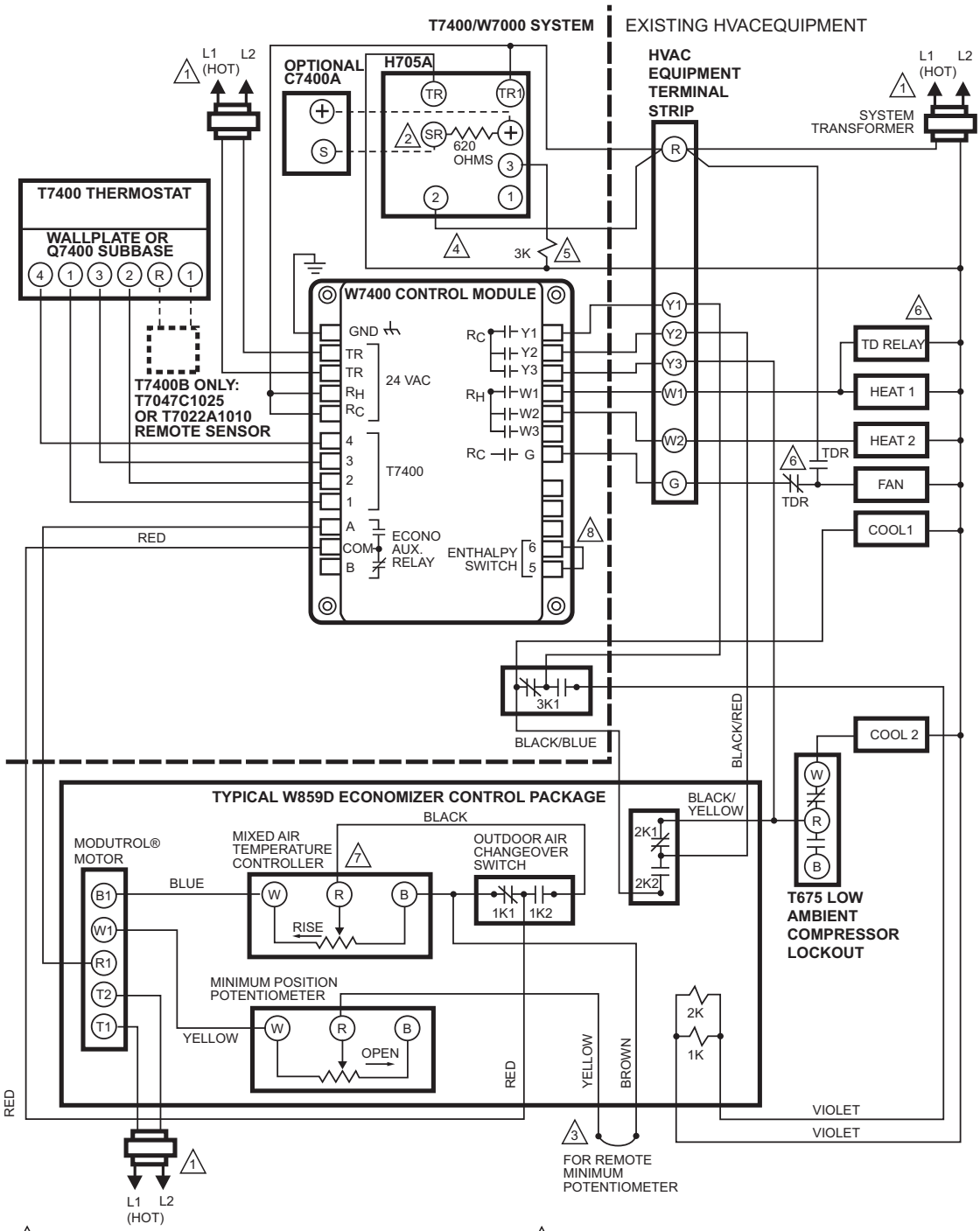
H705A used in electromechanical system



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. FACTORY-INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400A SENSOR IS ADDED TO SR AND + FOR DIFFERENTIAL ENTHALPY.
3. ENTHALPY CONTROL MAKES TERMINALS 2-1 ON ENTHALPY RISE, AND 2-3 ON ENTHALPY FALL.
4. RELAY REQUIRED (R8222 OR SIMILAR).
5. ECONIMIZER MOTOR SPRING RETURNS CLOSED ANY TIME FAN IS NOT RUNNING.
6. FIELD INSTALLED JUMPER.
7. IMPORTANT: MIXED AIR SENSOR MUST BE LOCATED DOWNSTREAM OF THE EVAPORATOR COIL IN THE DISCHARGE AIR DUCT TO PROVIDE ECONOMIZER LOW LIMIT FUNCTION.
8. 24 VAC ONLY.
9. MUST BE ABLE TO CARRY ADDITIONAL 6 VA LOAD OF COMMERCIAL THERMOSTAT AND SUBBASE.

M12167A

T7300/Q7300 using W859D Economizer Package with H705A in two-stage heating/two-stage cooling system, defeating economizer minimum position during unoccupied periods



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 FACTORY-INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400A SENSOR IS ADDED TO SR AND + FOR DIFFERENTIAL ENTHALPY.

3 YELLOW AND BROWN LEADS ARE SHORTED TOGETHER WHEN SHIPPED. LEAVE SHORTED IF OPTIONAL FUNCTIONS ARE NOT USED.

4 ENTHALPY CONTROL MAKES TERMINALS 2-1 ON ENTHALPY RISE, AND 2-3 ON ENTHALPY FALL.

5 PILOT DUTY RELAY REQUIRED (R8222N OR SIMILAR).

6 THIS CONTROL IS AN EXISTING DEVICE, WHICH MAY BE A TIME DELAY RELAY (TDR) OR L4604 (OR SIMILAR FAN CONTROL) IN SOME SYSTEMS.

7 IMPORTANT: MIXED AIR SENSOR MUST BE LOCATED DOWNSTREAM OF THE EVAPORATOR COIL IN THE DISCHARGE AIR DUCT TO PROVIDE ECONOMIZER LOW LIMIT FUNCTION.

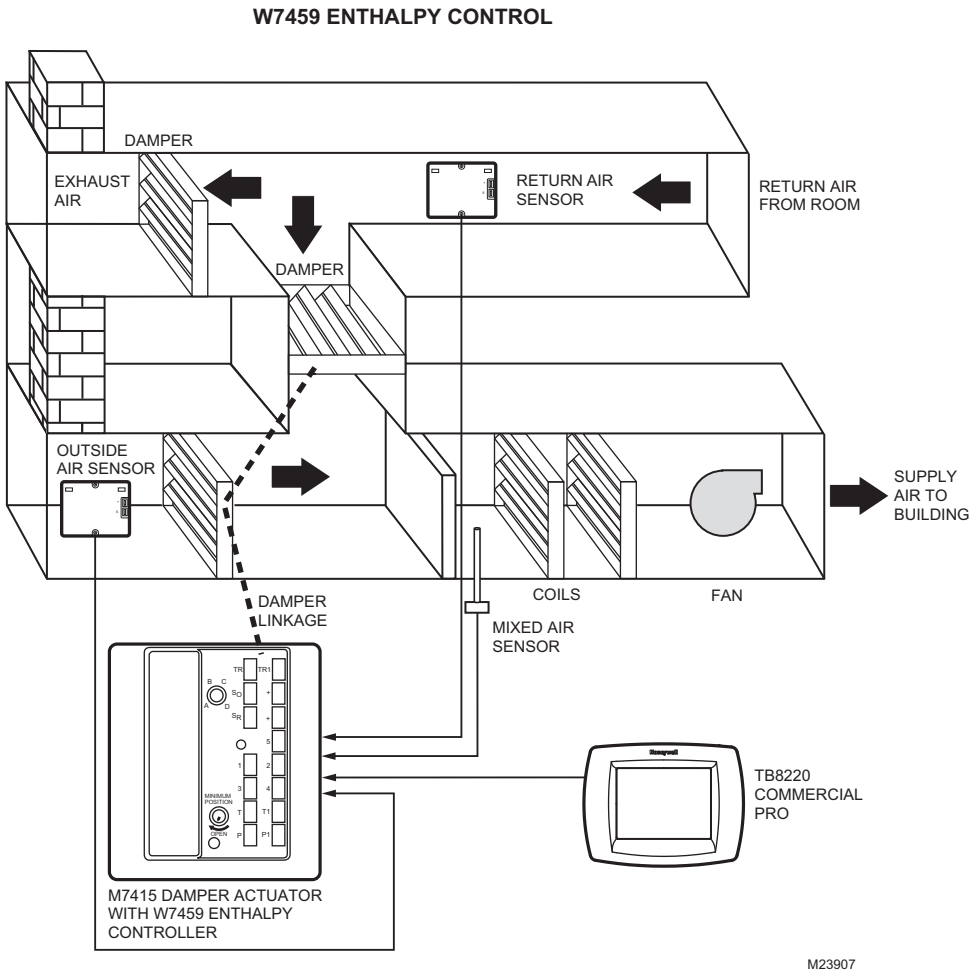
8 JUMPER TERMINALS 5 AND 6.

M12166

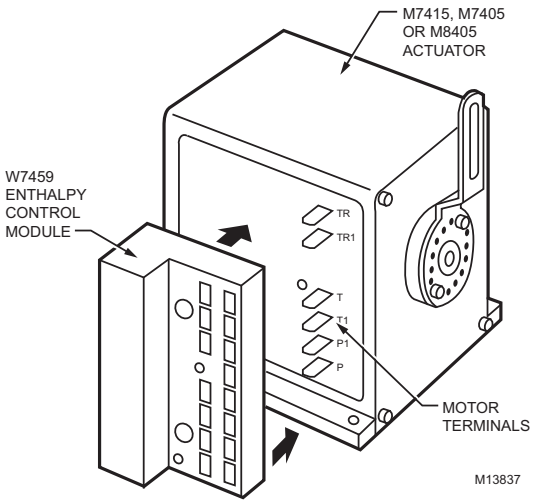
H705A used with T7400C and W7400C with separate transformer in two-stage heating/ three-stage cooling system with first stage dedicated to economizer setpoint, and either electromechanical economizer or mechanical cooling first stage

Section 5 - W7459 Economizer Module
FOR USE WITH M74XX SERIES ACTUATORS

W7459 Enthalpy Module Components



The W7459 is used in conjunction with a Honeywell actuator (M7415) and sensors to control outdoor and return air dampers free cooling using outside air. It is designed to be installed directly on the actuator.



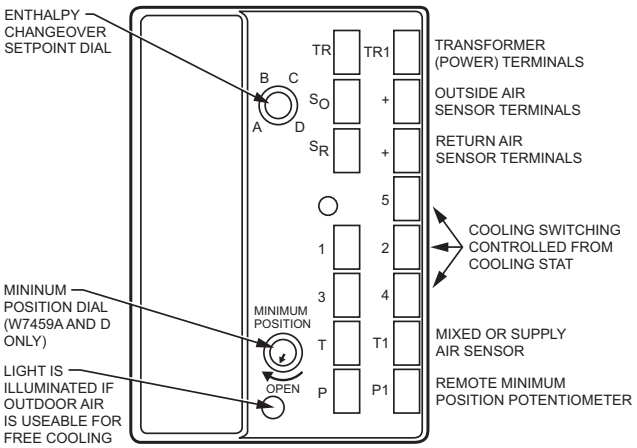
The W7459 is used with Honeywell C7400 enthalpy or C7650 dry bulb temperature sensors and the M7415, M7405, and M8405 actuators. It should be in free flowing air yet out of direct rain or sunlight. It can be used as a single or differential enthalpy control. A minimum position potentiometer is built into all W7459 modules except for the W7459C since the M8405 actuator, that it is used with, has the setting built-in. All W7459 modules can be used with remote minimum position potentiometers. See Table 1 for model capability with motors.

Table 1. Economizer Usage

Model	For use with Actuator	Discharge Air Temperature Input	Minimum Position Potentiometer	Terminals for Remote Minimum Damper Position	Output Relays
W7459A	M7415	C7510B or C7046A Sensor	Yes	Yes	2 SPDT
W7459B	M7405A	Direct digital control W7401/W7411 Logic Panel	Yes	Yes	1 SPDT
W7459C	M8405	SPST control	No. Minimum position adjustment is built into M8405 Actuator.	No	2 SPDT
W7459D[a]	M7415	C7150B or C7046A Sensor	Yes	Yes	2 SPDT

a W7459D has a high enthalpy limit and defaults to mechanical cooling when the outdoor enthalpy reaches the preset limit. Do not use a dry bulb sensor for a high temperature limit.

W7459A, B, C and D



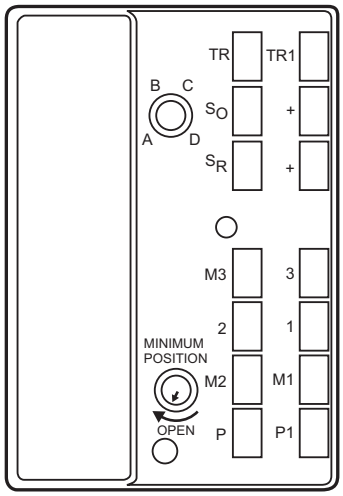
NOTE: USE SMALL SCREWDRIVERS ON THE POTENTIOMETERS. DO NOT USE EXCESSIVE FORCE!

M23894

W7459A

W7459A or D - Uses inputs from mixed or discharge air temperature sensors, C7150 or C7046; enthalpy sensor C7400; and optional remote minimum position potentiometer Q709A or S963B. The W7459D is identical to the W7459A except for the addition of a built-in enthalpy high limit. Refer to page 56 for more information on the high limit function. Use both modules with M7415 motors.

There are four separate W7459 enthalpy logic modules for use with various M74XX series actuators. All provide enthalpy control of mixed air. The W7459B is designed for use with a legacy Honeywell direct digital controller. The W7459C uses a SPST input for the mixed air sensor.

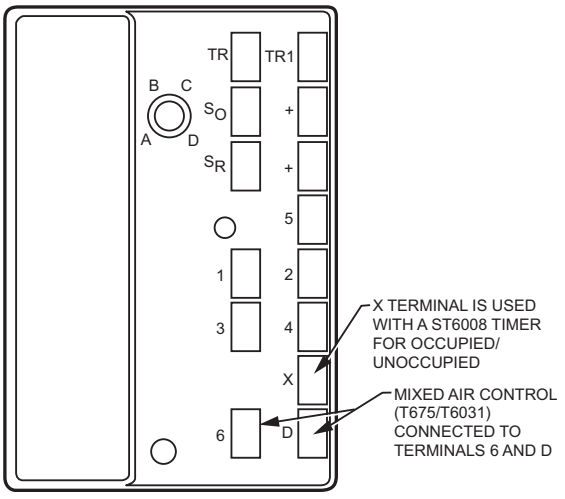


NOTE: USE SMALL SCREWDRIVERS ON THE POTENTIOMETERS. DO NOT USE EXCESSIVE FORCE!

M23895

W7459B

W7459B - Used with Honeywell W7401 Logic Panel, enthalpy sensor C7400 or minimum position potentiometer Q709A or S963B. Use with M7405.



NOTE: USE SMALL SCREWDRIVERS ON THE POTENTIOMETERS. DO NOT USE EXCESSIVE FORCE!

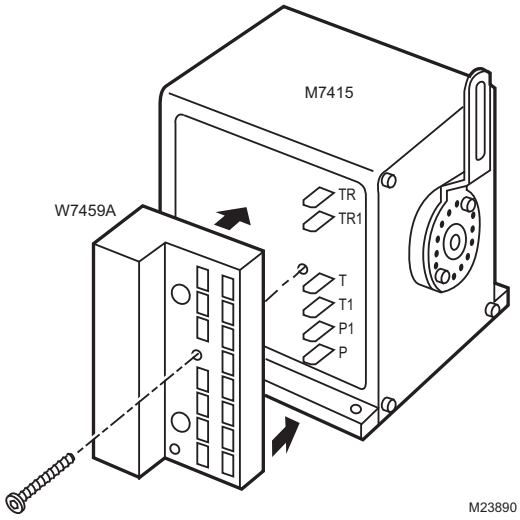
M23896

W7459C

W7459C - Uses input from SPST mixed or discharge air control and enthalpy sensor C7400. Used with M8405.

M7215, M7415, M7405 and M8405 Actuators

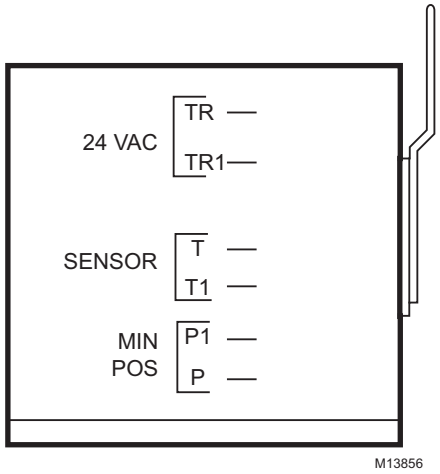
M7215 modulating motor, with 2-10 Vdc input required.



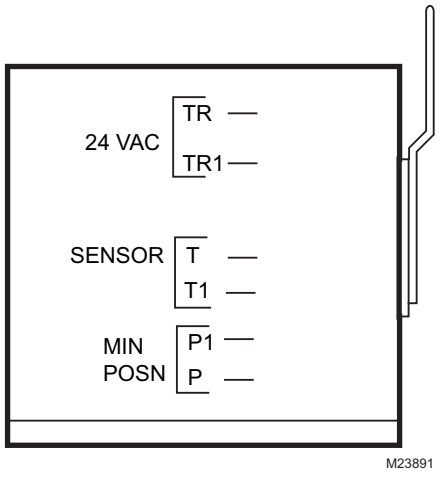
The M7415 line of spring return actuators are:

- Low torque 25 lb-in. (2.8 N-m)
- 90 second timing
- Rotation of 90 degrees
- Quick connect terminals for wiring connections

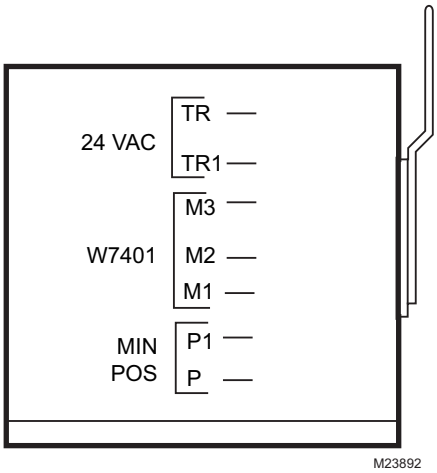
There are more actuators available in this series than listed on this page. Only actuators shown on this page are used with the W7459, W7210, W7212, W7215 and W7340 economizer modules. They are widely used to modulate the mixed air dampers on smaller rooftop air handlers since the operating temperature rating is -25 to 125°F (-32 to 52°C).



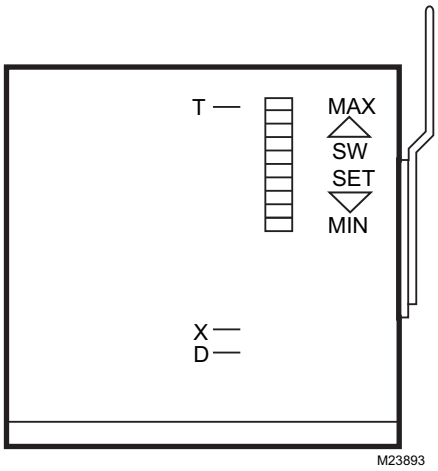
M7215 modulating motor. Used with W7212, W7213 or W7214 only



M7415 modulating motor, sensor input or controller required. Used with W7459A or D only.

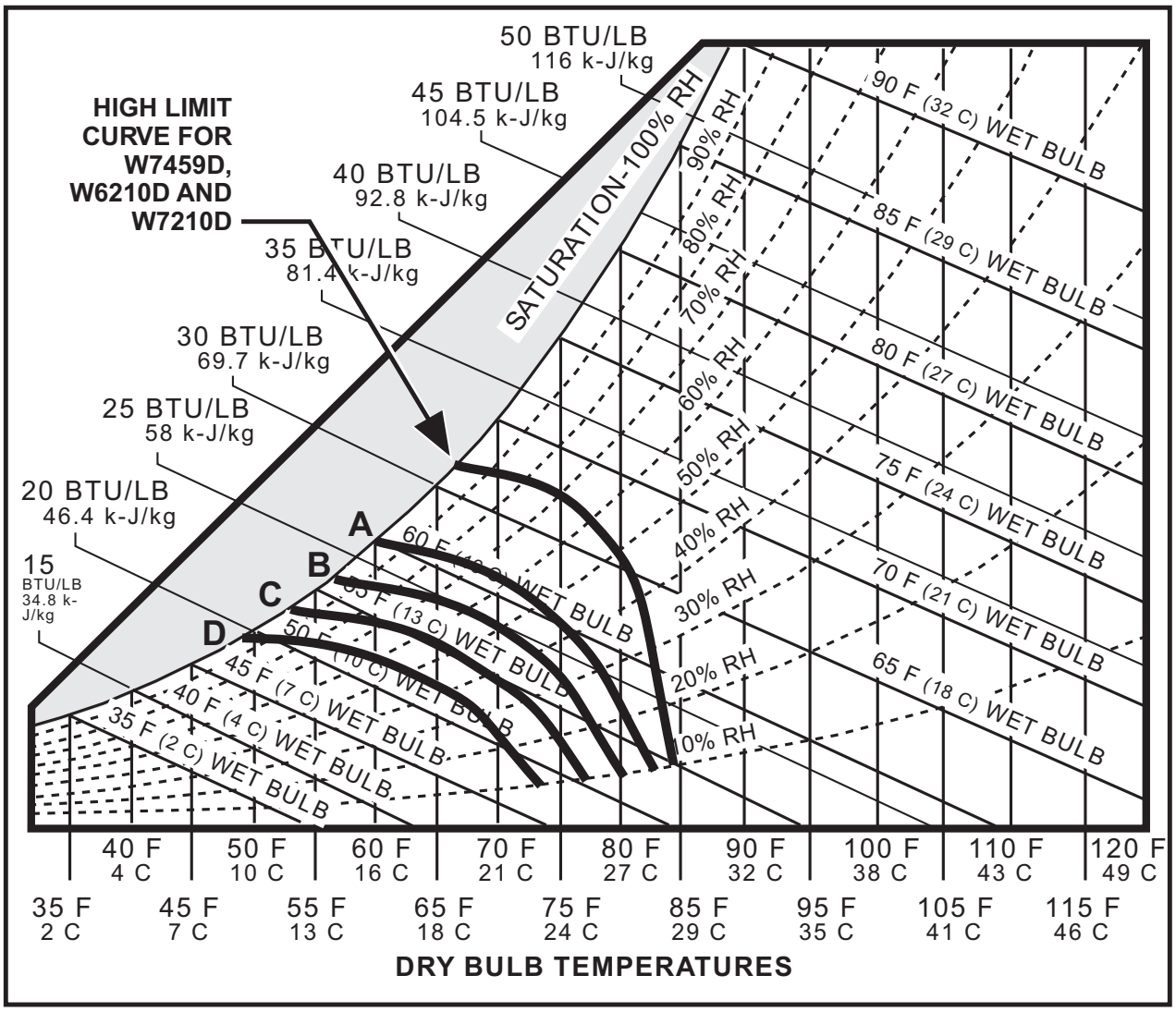


M7405 modulating motor. Used with W7459B and W7400/T7400 only.



3 position actuator. Used with W7459C only.

W7459 Enthalpy Setpoint Chart



M25283

This is the psychrometric chart for the setpoint on the W7459 enthalpy modules. It is similar to the charts for the H705 except for the enthalpy high limit line to the right of the A curve. This is a specialized limit used only in the W7459D, W6210D, W7210D and W7212 controllers. When the enthalpy of both the return and outside air is to the right of the limit line the outside air dampers are closed to the minimum position and the mechanical cooling is energized.

Control Curve	Control Point (Approximate Temperature at 50% Humidity)
A	73°F (23°C)
B	70°F (21°C)
C	67°F (19°C)
D	63°F (17°C)
Knob turned to D	For Differential Enthalpy (2 Sensor)

High Limit Switching

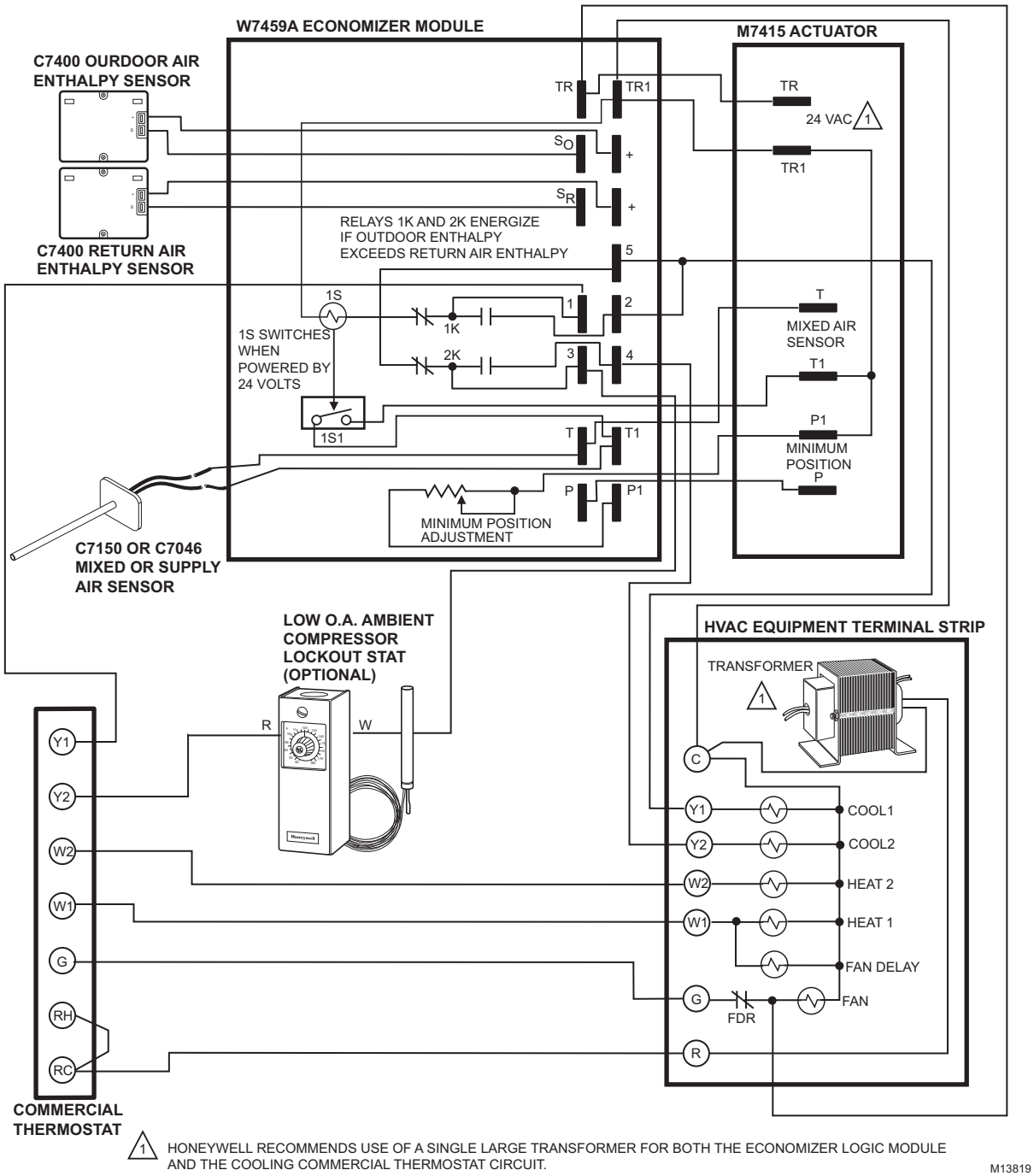
Table 2. W7459D, W7210D and W7212 High Limit Switching.

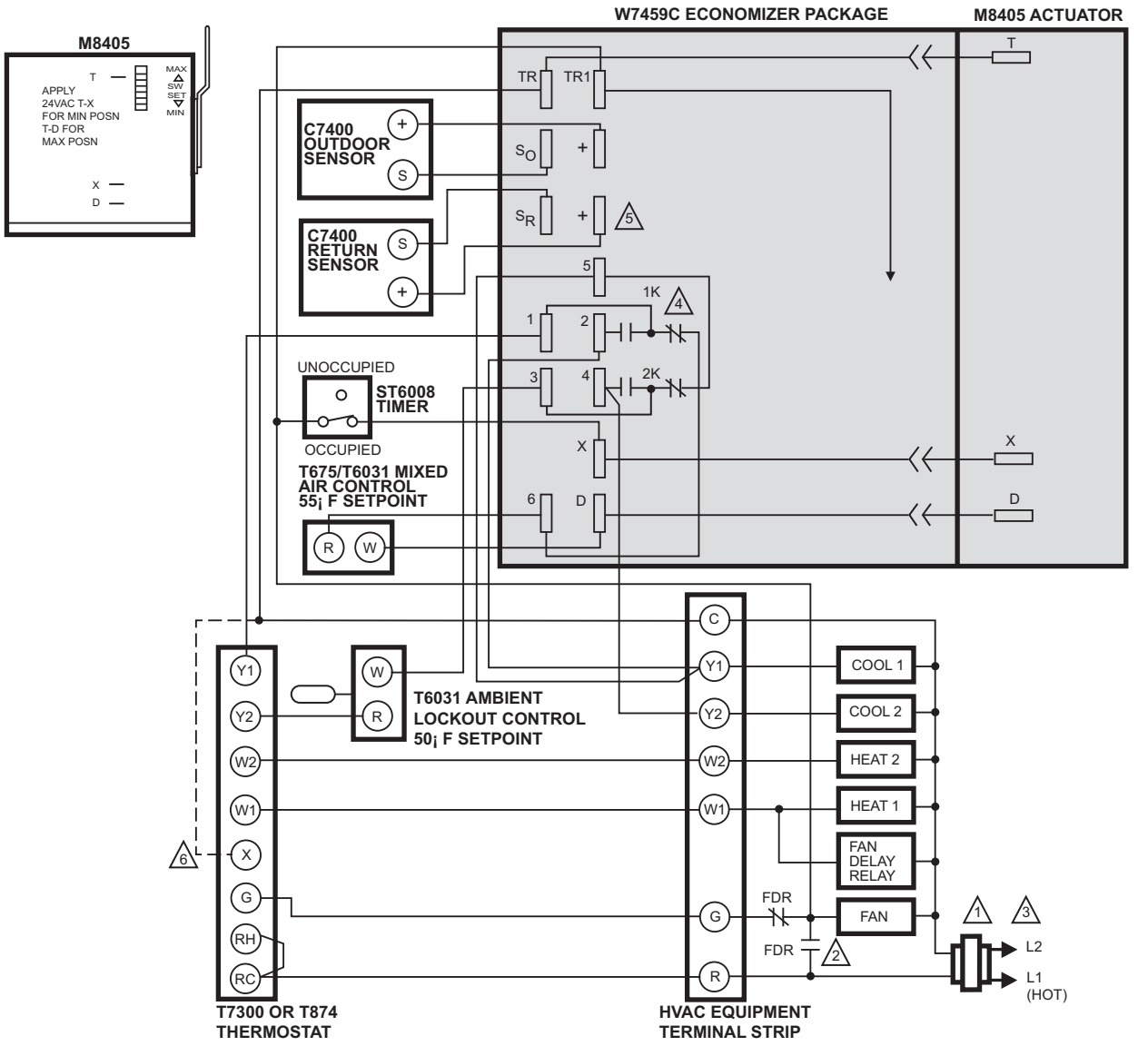
Percent RH	Free Cooling Light on Enthalpy Decreasing	Free Cooling Light Off Enthalpy Increasing
25	83°F ±0.5°F (28°C ±0.3°C)	85°F ±0.5°F (29°C ±0.3°C)
50	78°F ±0.5°F (26°C ±0.3°C)	80°F ±0.5°F (27°C ±0.3°C)
60	76°F ±0.5°F (24°C ±0.3°C)	78°F ±0.5°F (26°C ±0.3°C)
75	73°F ±0.5°F (23°C ±0.3°C)	75°F ±0.5°F (24°C ±0.3°C)

The W7459D, W6210D, W7210D, and W7212 include the high limit function that is not used on any other economizer modules. It is a high enthalpy limit that applies to both return and outside air. It only applies to differential, not single enthalpy. When the return and outside enthalpy both exceed the high limit curve, (refer to the psychrometric chart on the previous page) the outside air dampers are closed to the minimum position and the mechanical cooling is energized. In a standard differential enthalpy control sequence the lower of the outside and return is selected regardless of the amount of enthalpy in either.

A typical application of this limit function is a building located in a warm, humid climate with a high internal heat gain such as a laundry or kitchen. A standard differential enthalpy control circuit may have extremely warm, humid outside air being cooled just because the indoor air is temporarily higher in enthalpy. The mechanical cooling equipment might be undersized and the indoor enthalpy then remains higher than outside. The high limit function (only available on some economizer modules) prevents this from occurring by automatically switching to return air and turning on the mechanical cooling during very high outdoor air enthalpy conditions.

W7459A Wiring Diagram

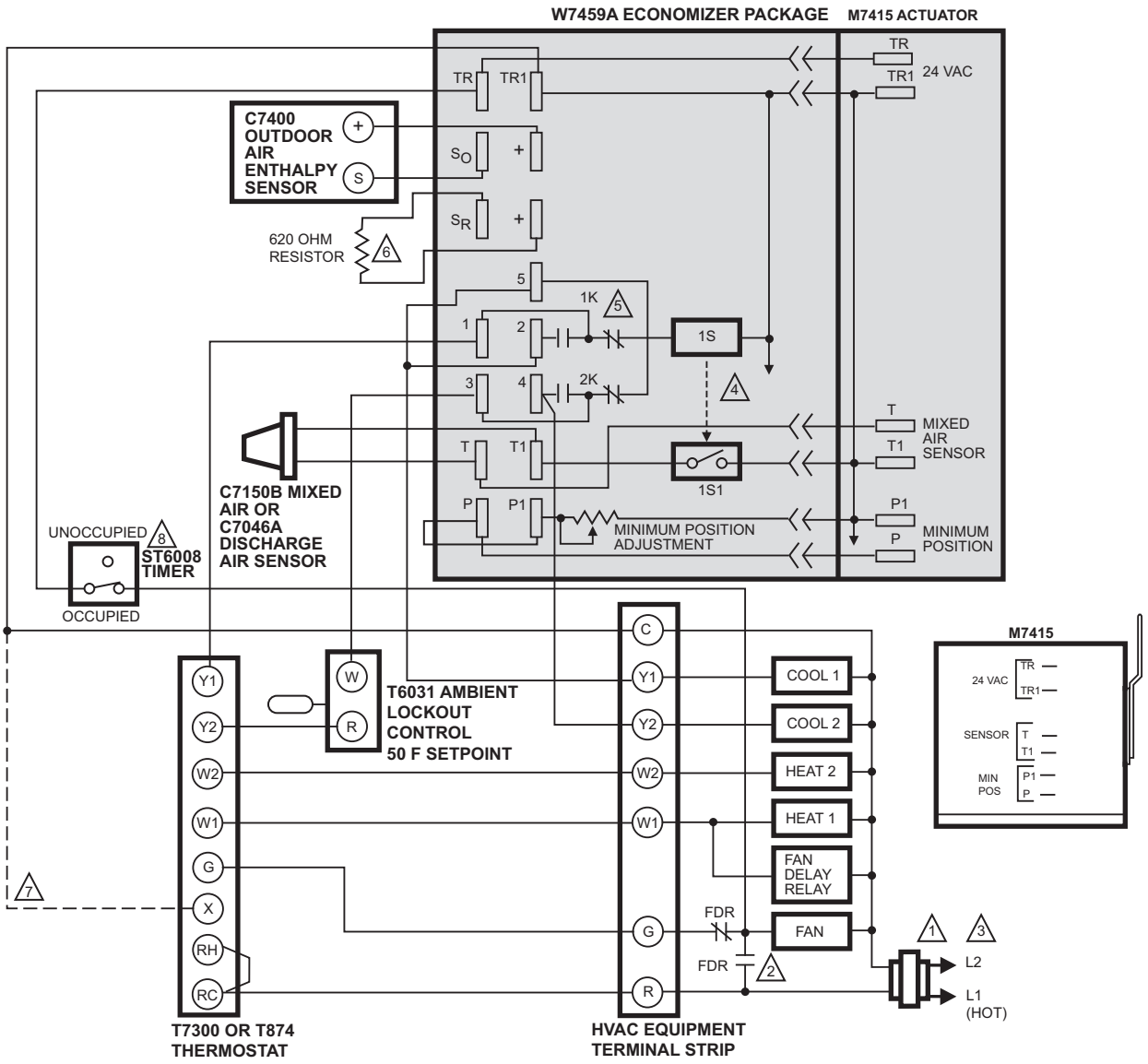




1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
5. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
6. FOR T7300 ONLY.

M3865B

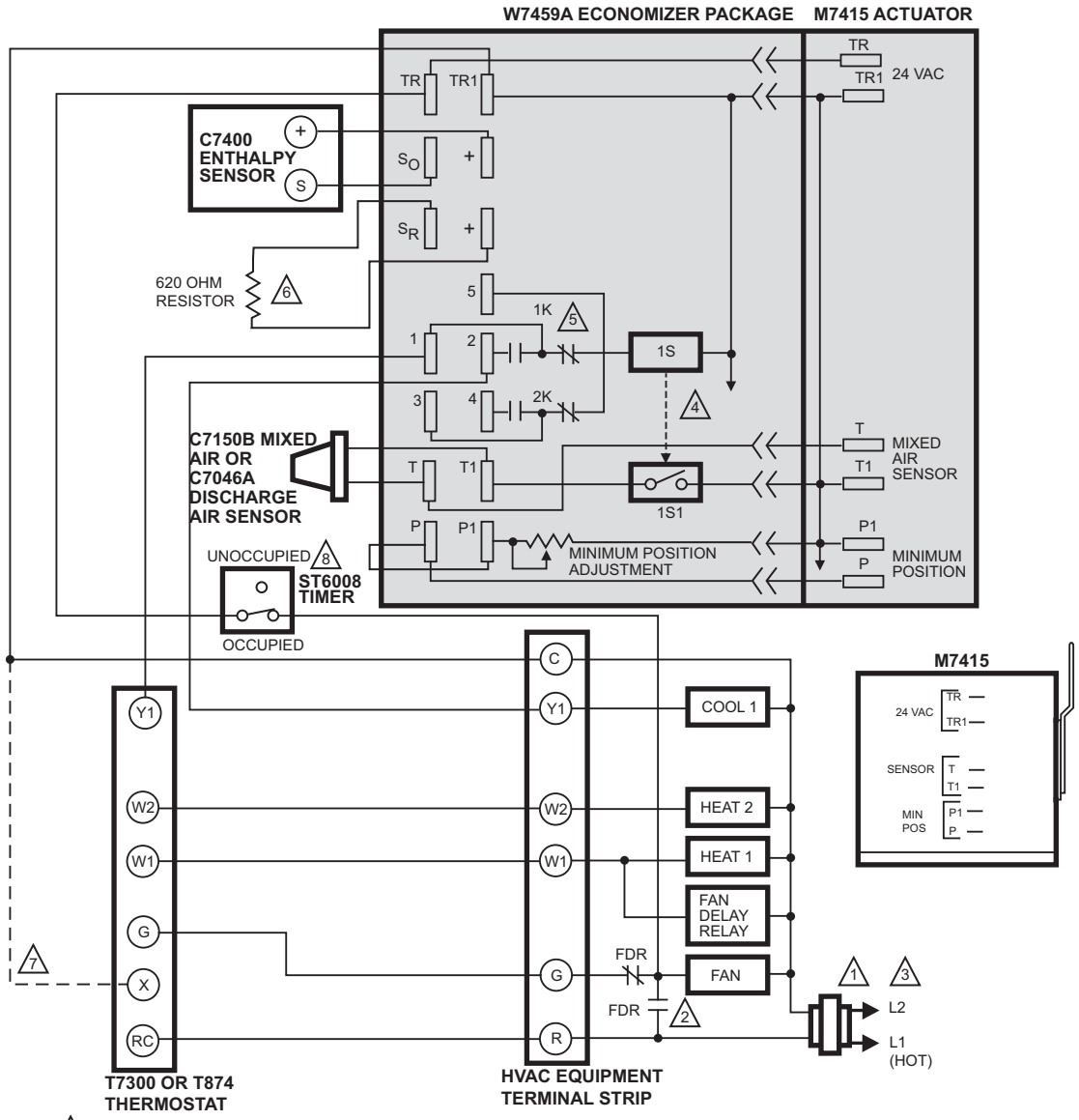
M8405A Damper Actuator used in two-stage cooling system with differential enthalpy changeover and W7459C Economizer



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. WITH T7300, USE CONTACTS A_1 AND A_2 INSTEAD OF S7005 TIMER.

M10115A

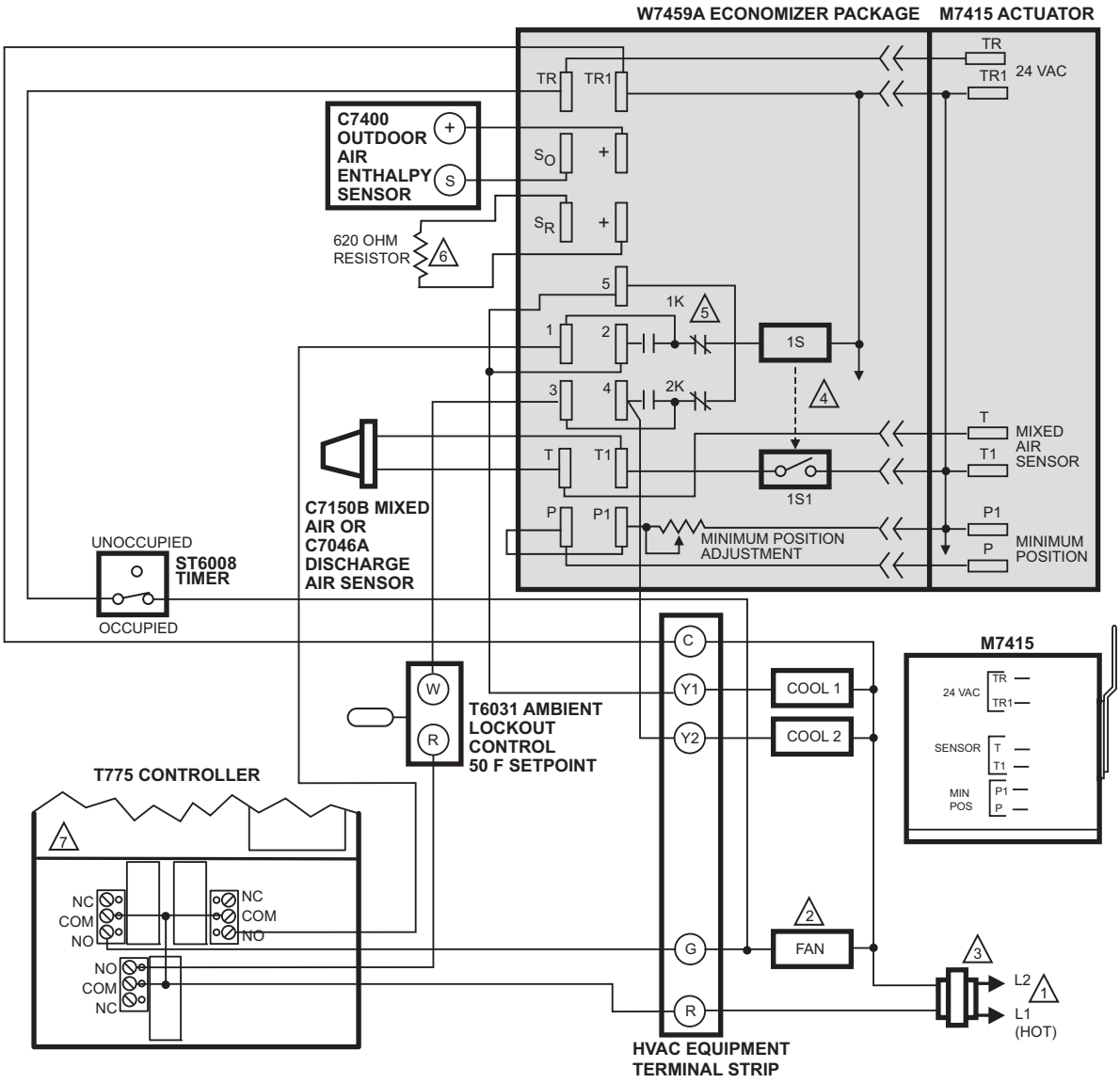
W7459A/C7400 used in two-stage cooling system with single enthalpy changeover and with M7415 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.
7. FOR T7300 ONLY.
8. WITH T7300, USE CONTACTS A_1 AND A_2 INSTEAD OF A TIMER.

M10114A

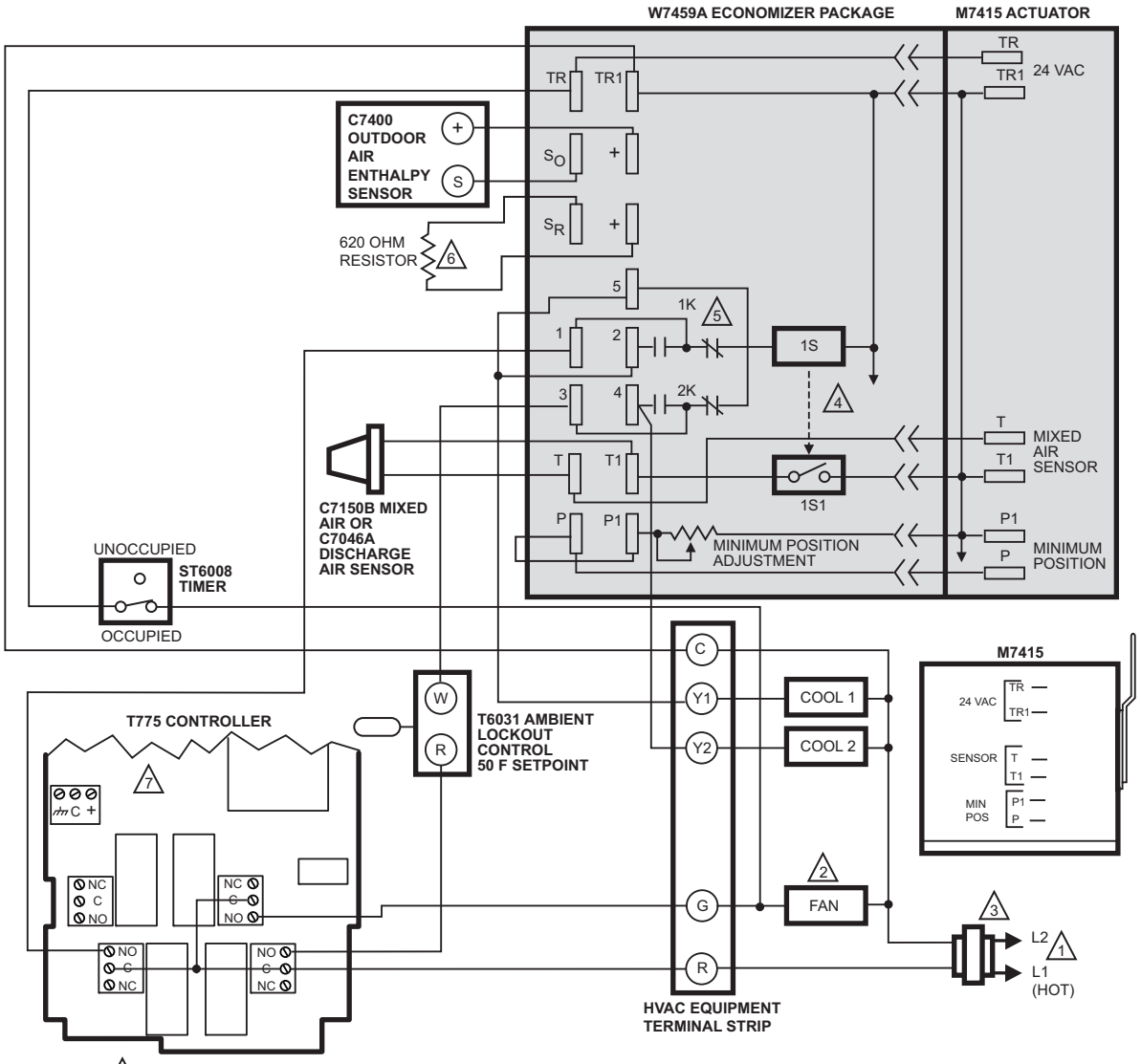
W7459A/C7400 or W7459D/C7400 used in one-stage cooling system with single enthalpy changeover, M7415 Actuator, and one-stage cooling thermostat



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH, WHICH CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL. A MAXIMUM OF ONE STAGE OF HEATING IS POSSIBLE WHEN THE SYSTEM IS WIRED IN THIS FASHION.

M11680A

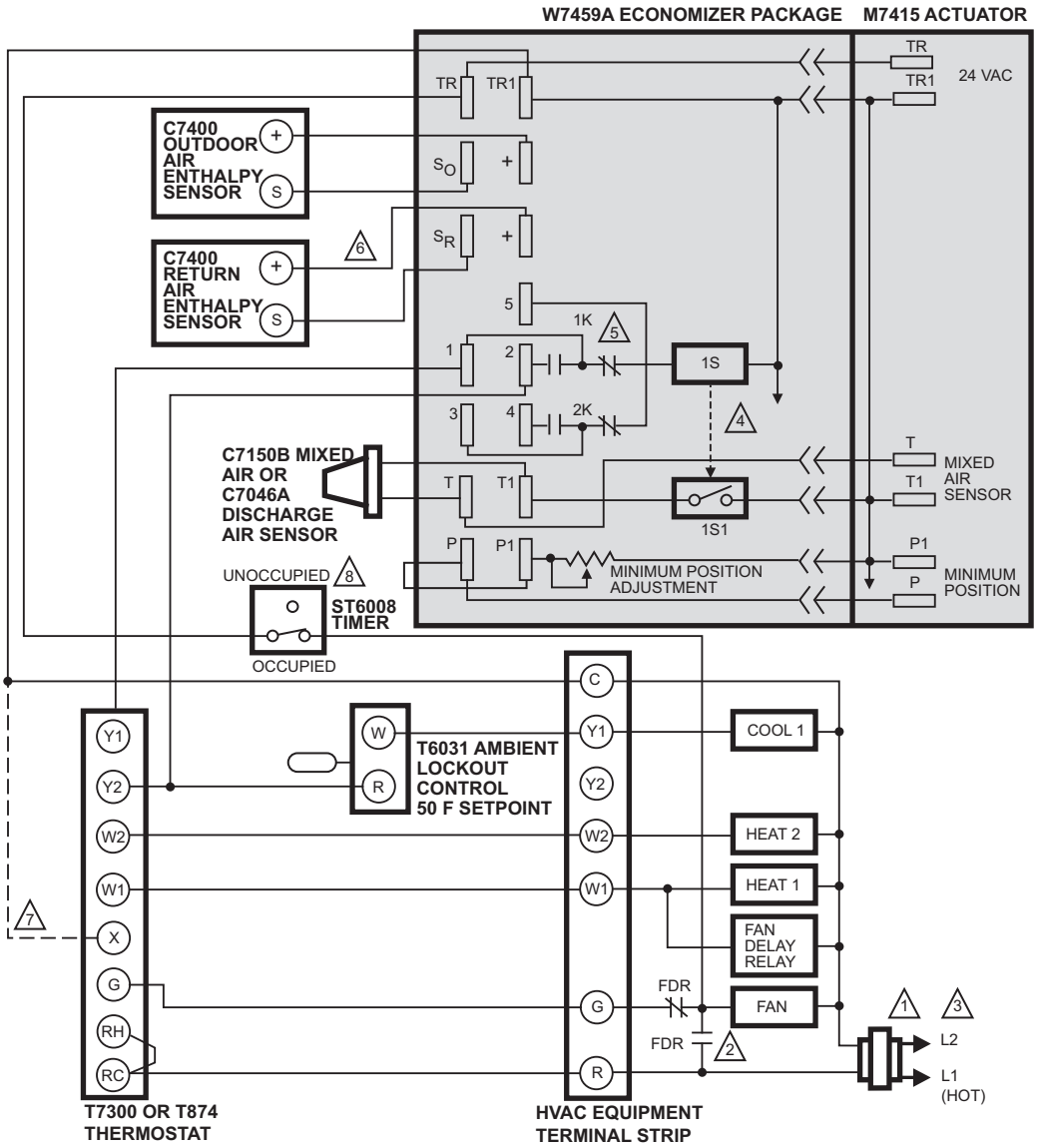
W7459A/C7400 or W7459D/C7400 used in two-stage cooling system with single enthalpy changeover, M7415 Actuator, and T775 Series 1000 Controller



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH, WHICH CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL.

M13843

W7459A/C7400 or W7459D/C7400 used in two-stage cooling system with single enthalpy changeover, M7415 Actuator, and T775 Series 2000 Controller



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 RELAYS 1K AND 2K ACTUATE WHEN THE OUTDOOR AIR ENTHALPY IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

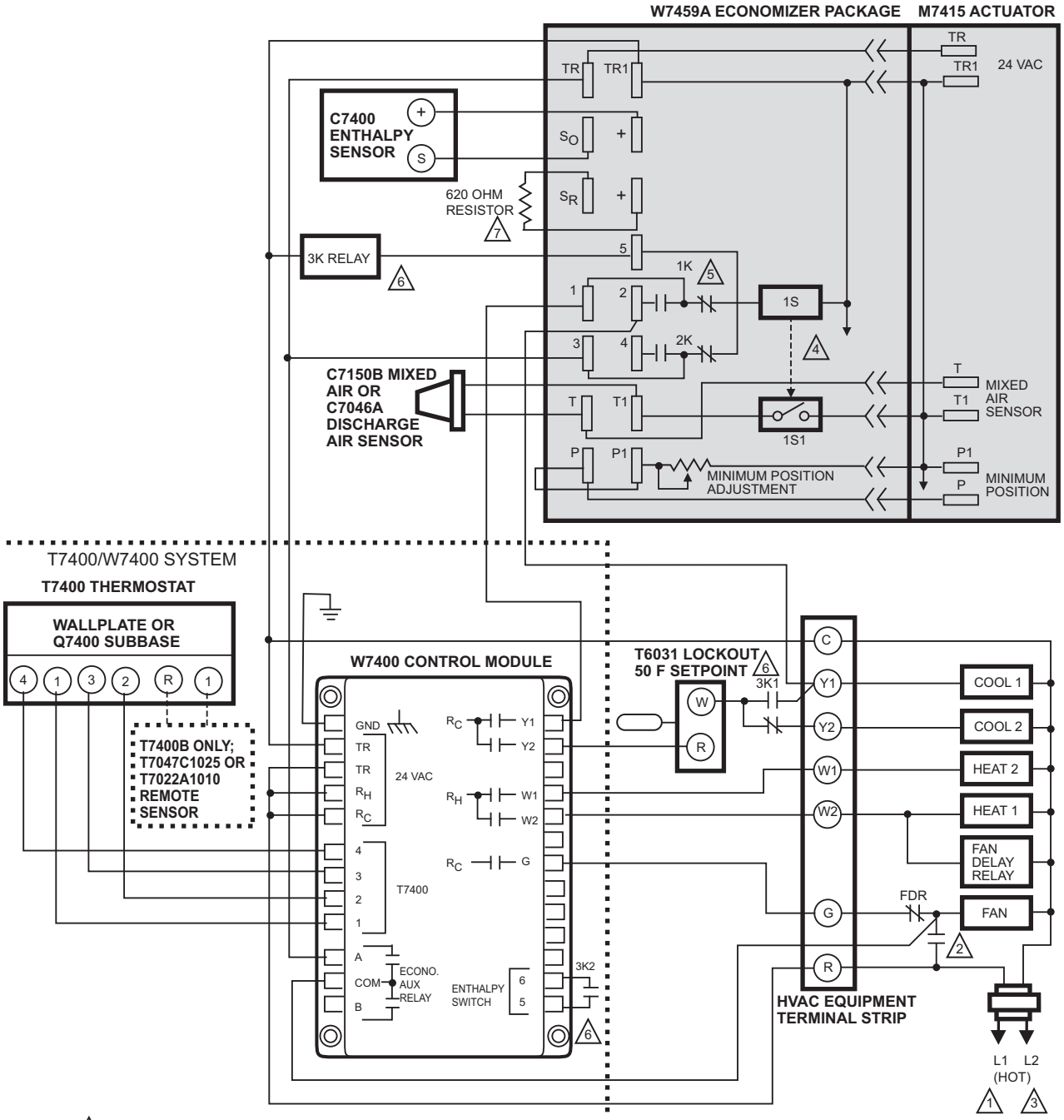
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 FOR T7300 ONLY.

M3864B

8 WITH T7300, USE CONTACTS A_1 AND A_2 INSTEAD OF A TIMER.

W7459A/C7400 or W7459D/C7400 used in one-stage cooling system with differential enthalpy changeover and M7415 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 MOTOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

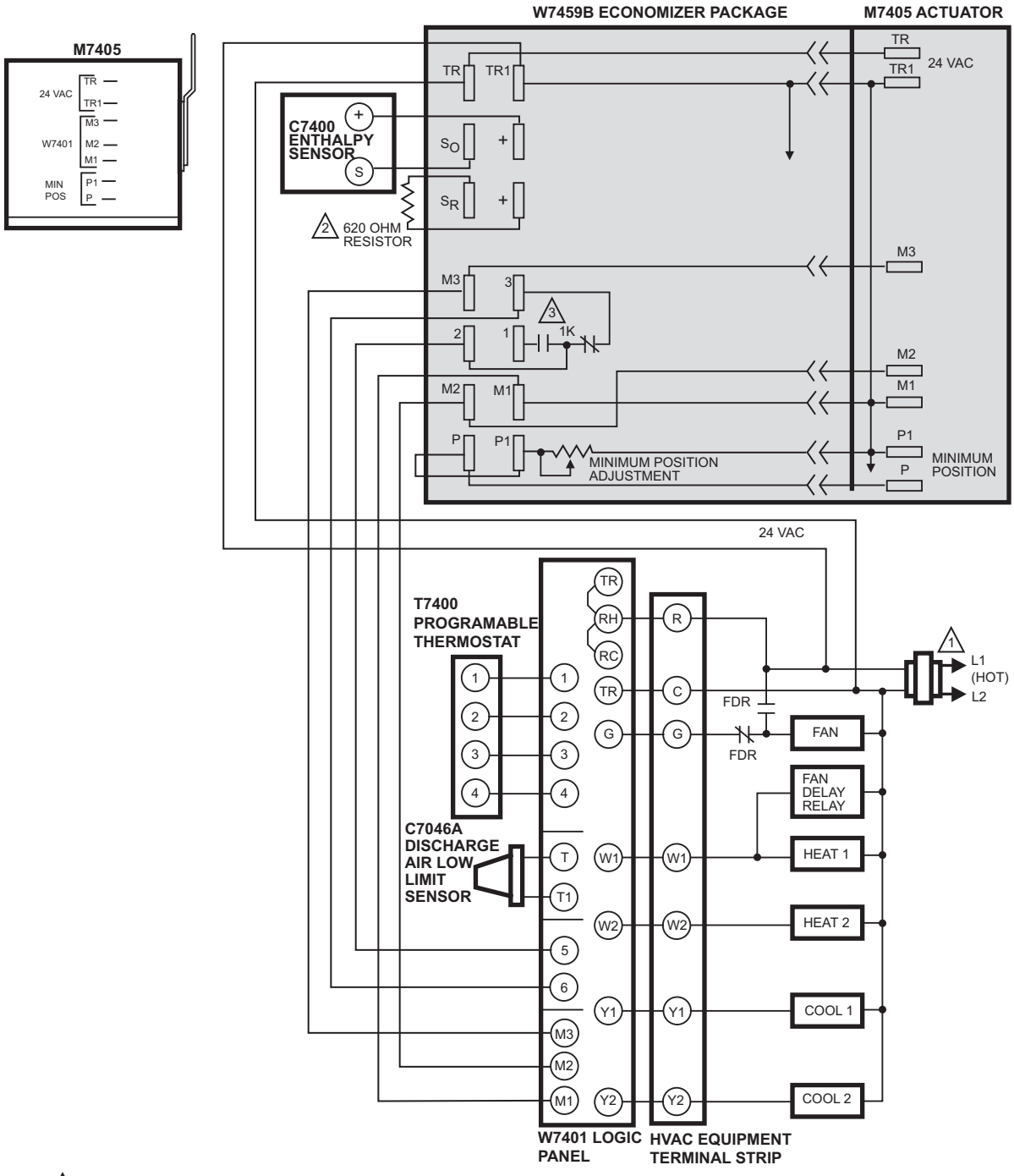
5 RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

6 USE R8222N WITH PILOT DUTY CONTACTS FOR 3K. CONTACTS 3K1, 3K2 MAKE WHEN ENTHALPY IS BELOW SETPOINT AND ECONOMIZER IS USED FOR FIRST STAGE OF COOLING.

7 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

M10117A

W7459A/C7400 or W7459D/C7400 used in T7400/W7400 System with M7415 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

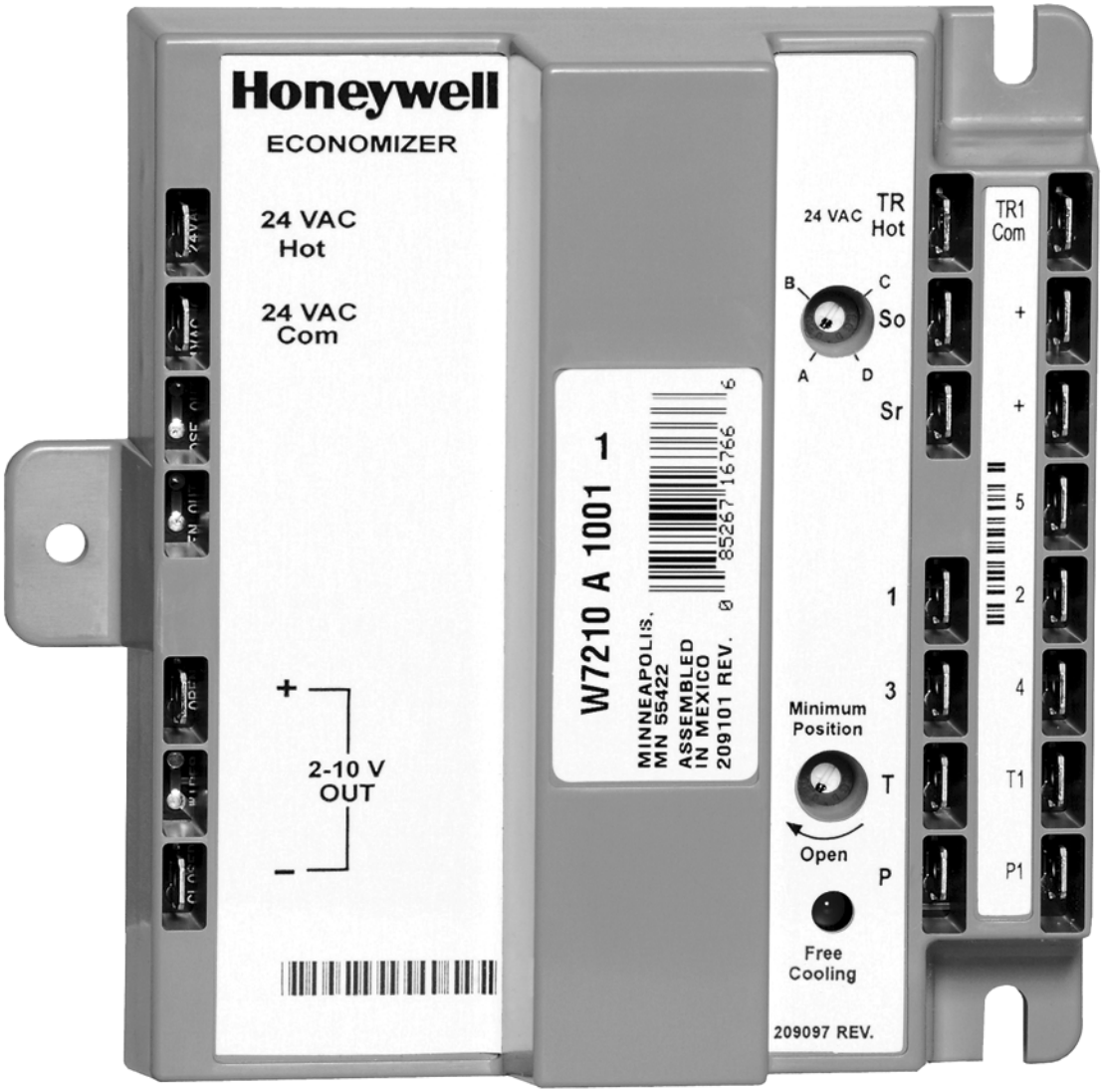
3 RELAY 1K ACTUATES WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

M3863

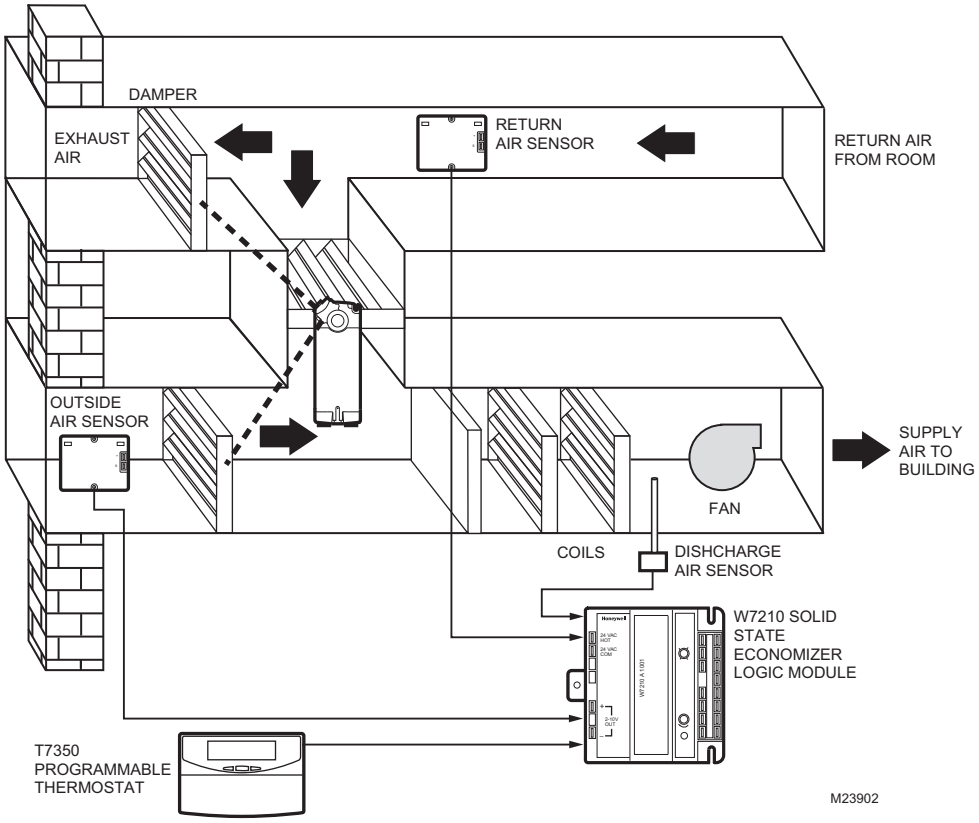
W7459B/C7400 used in two-stage cooling system with single enthalpy changeover, and M7405 Actuator

Section 5 - W7459 Economizer Module

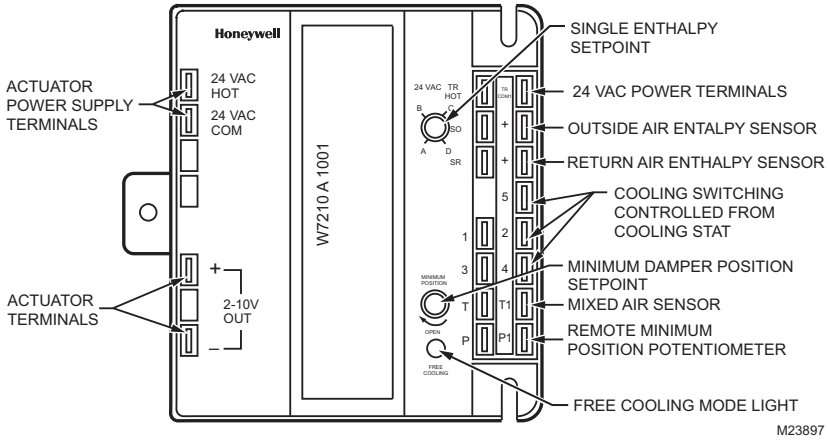
Section 6 - W6210 And W7210 Economizer Modules



W7210 Economizer System Components



W6210 and W7210 Components



The W7210 logic modules have the identical functions as the W7459 modules with the addition of a 2-10 Vdc output for use with M7215 foot-mounted actuators or DCA's and Modutrol Motors with 2-10 Vdc control. The mixed air control circuit is in the logic module and no longer in the actuator. The actuator can also be powered with the same 24 Vac power as the logic modules provided the internal grounding of the actuator is compatible. Note some of the Siemens actuators are not compatible with the M7210. Older models that are no longer available are the W6210A and D models. These models were used in the mid 1990's with floating actuators. Since the floating actuators do not provide as accurate control as the modulating actuators, these logic modules have been discontinued.

High Limit Function

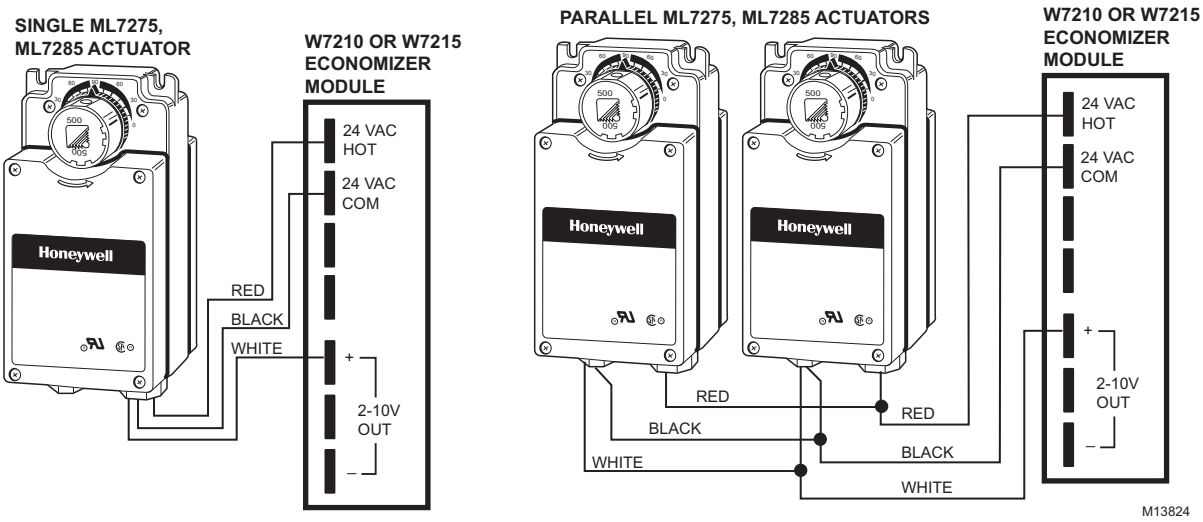
There are high limit versions of these economizer logic modules, W6210D and W7210D. When in the differential enthalpy mode and both the return and outside air enthalpy are above a preset level, the outside air dampers are returned to minimum position and the mechanical cooling is energized. The curve for this limit function is illustrated on the psychrometric chart as the line to the right of the A curve. Refer to page 55 of this guide for more information.

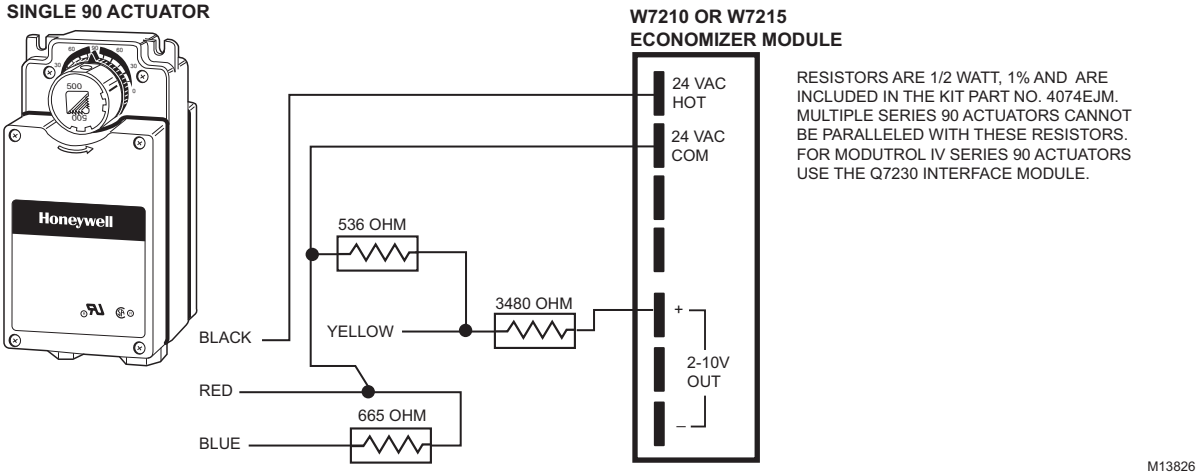
Wiring Connections

There are many possible wiring diagrams and combinations of controllers and actuators that can be used with the logic modules. Once you understand the input and output of the modules, you can usually determine how a system should be wired.

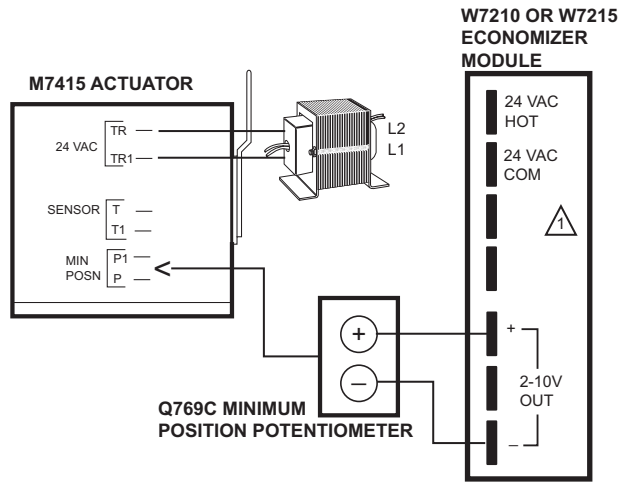
NOTE: Many user systems are wired to bypass operations and to "trick" the module into operating in a mode that it was not designed to do, these are the applications which may confuse you. When is doubt, call the unit supplier or refer to the product instructions for wiring diagrams.

W6210 and W7210 Actuator Connections

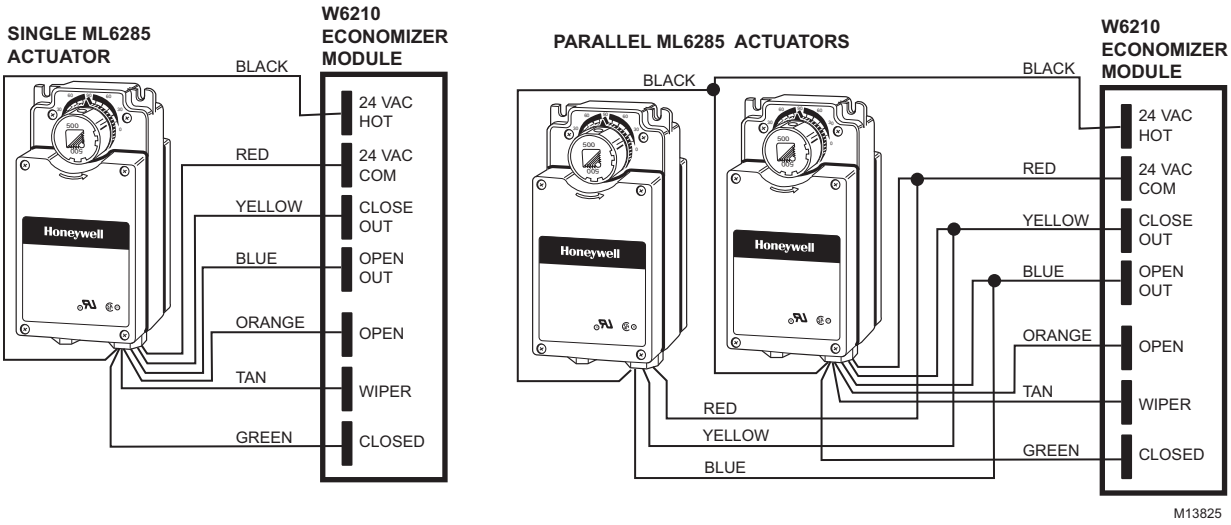


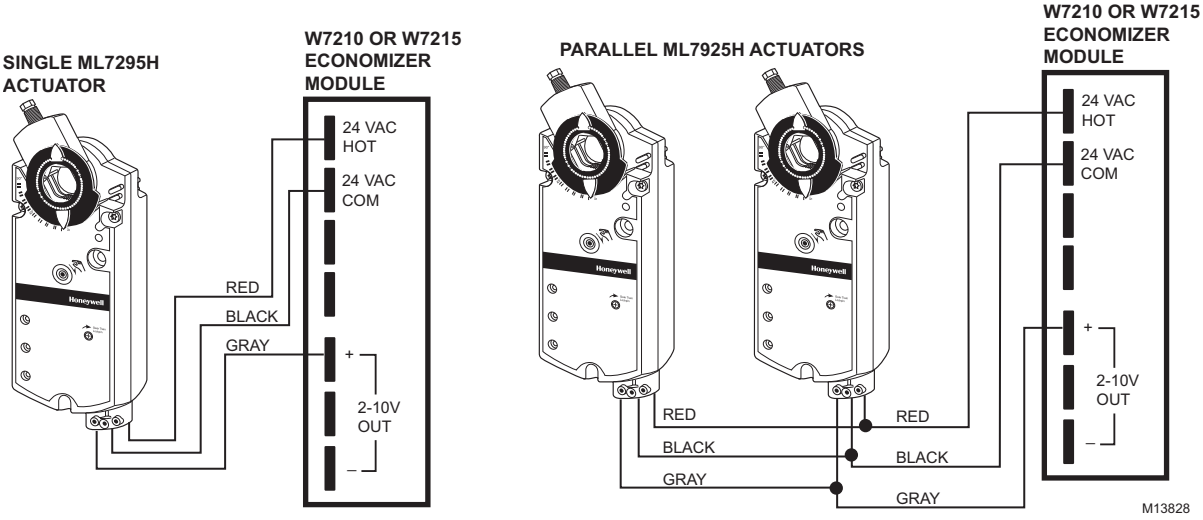


RESISTORS ARE 1/2 WATT, 1% AND ARE INCLUDED IN THE KIT PART NO. 4074EJM. MULTIPLE SERIES 90 ACTUATORS CANNOT BE PARALLELED WITH THESE RESISTORS. FOR MODUTROL IV SERIES 90 ACTUATORS USE THE Q7230 INTERFACE MODULE.



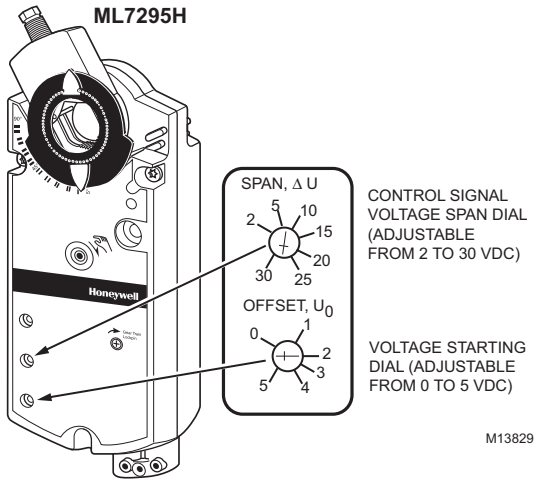
1 WHEN USING THE W7210 OR W7215 WITH A M7415 ACTUATOR, THE MIXED OR DISCHARGE AIR SENSOR MUST BE CONNECTED TO THE LOGIC MODULE AND **NOT** THE ACTUATOR.



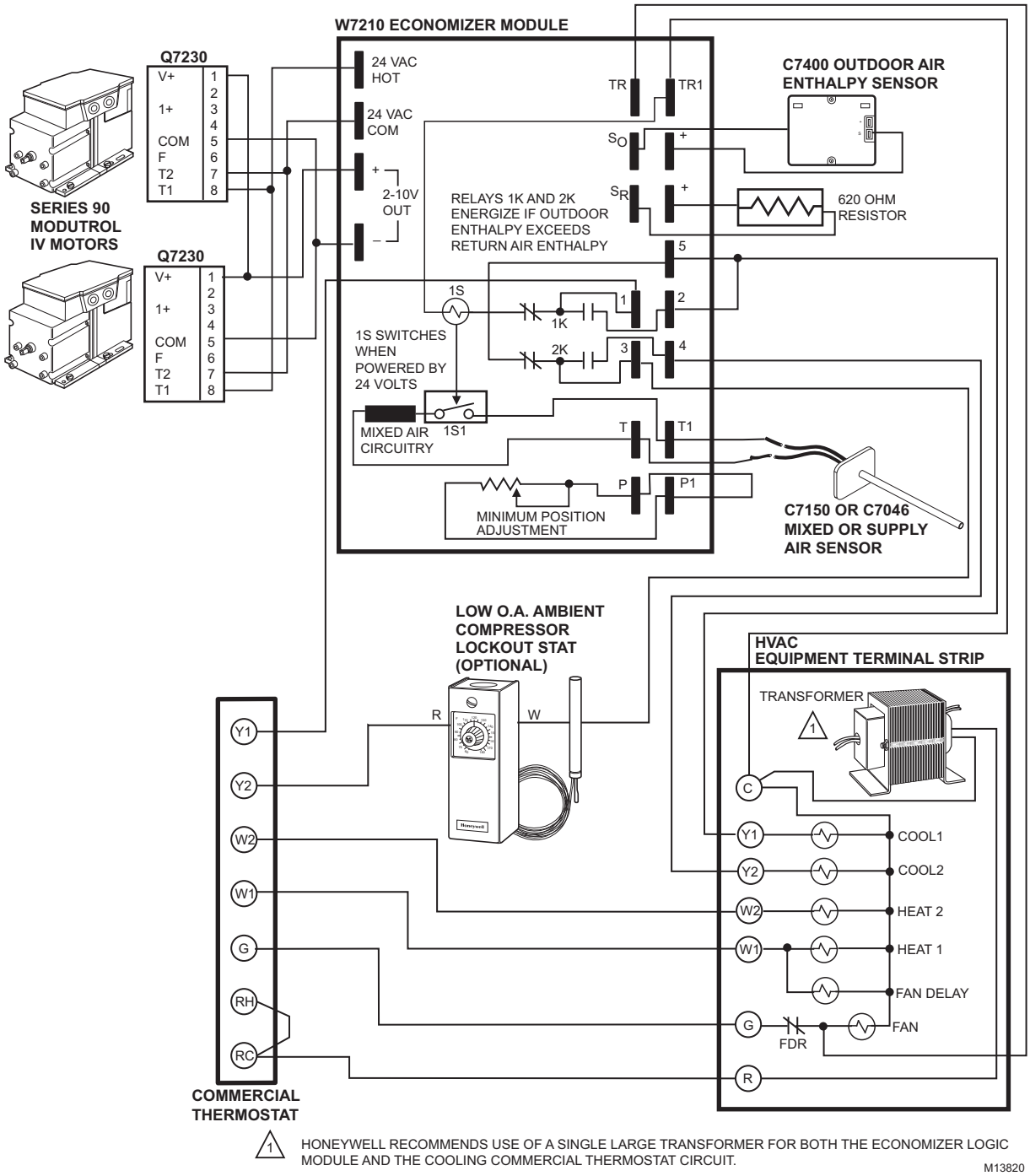


ML7295H setting for closed at 2 Vdc and open at 10 Vdc	
Startpoint—Labeled U_0 Actuator fully closed	2 Vdc
Range—Labelled ΔU Actuator fully open	8 Vdc

These are settings for a ML7295H used with a W7210 or W7215. The ML7295H is equipped with an input signal span and startpoint adjustment. The startpoint, labeled U_0, determines which voltage the control signal begins to reposition the actuator. The span, labelled ΔU, determines which voltage the actuator is at full position.

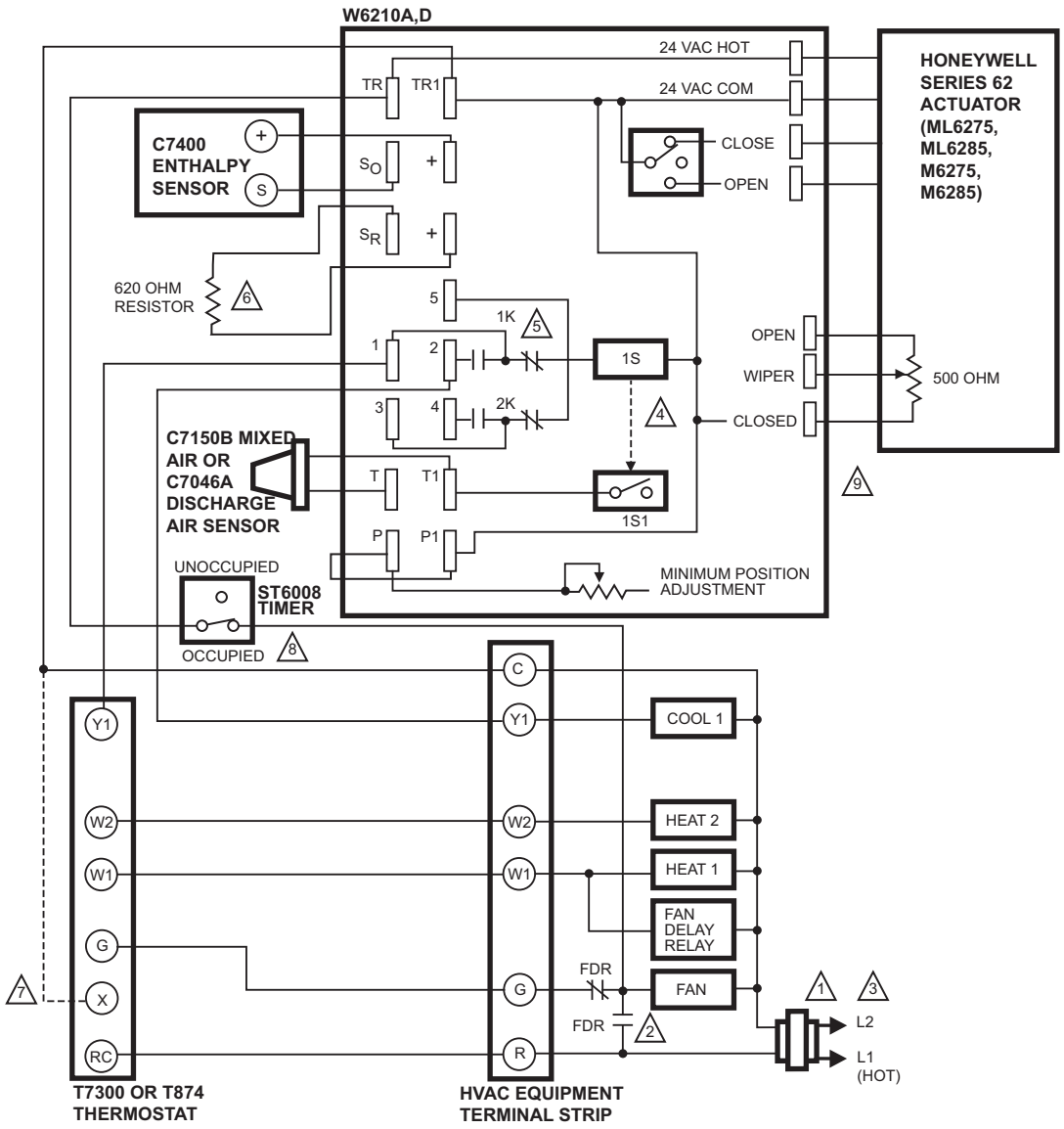


W7210 Wiring Diagrams



1 HONEYWELL RECOMMENDS USE OF A SINGLE LARGE TRANSFORMER FOR BOTH THE ECONOMIZER LOGIC MODULE AND THE COOLING COMMERCIAL THERMOSTAT CIRCUIT.

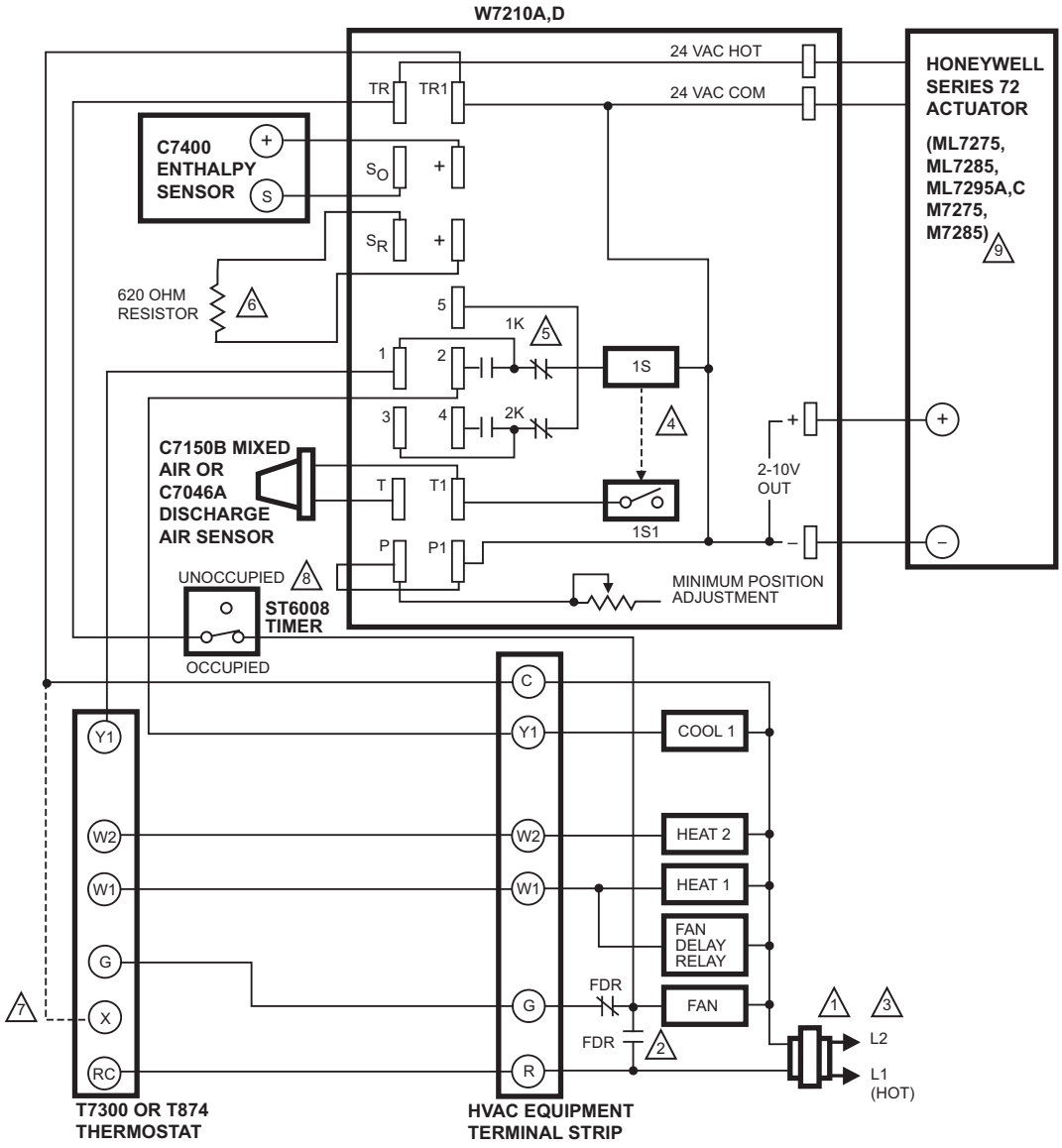
M13820



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A 1AND A 2NSTEAD OF THE TIMER.
9. THE COMMON FOR THE W6210A,D IS DIFFERENT FROM THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH ONE TO A DIFFERENT CIRCUIT.

M11151B

W6210A,D used in single-stage cooling system with single enthalpy changeover and Honeywell Series 62 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.

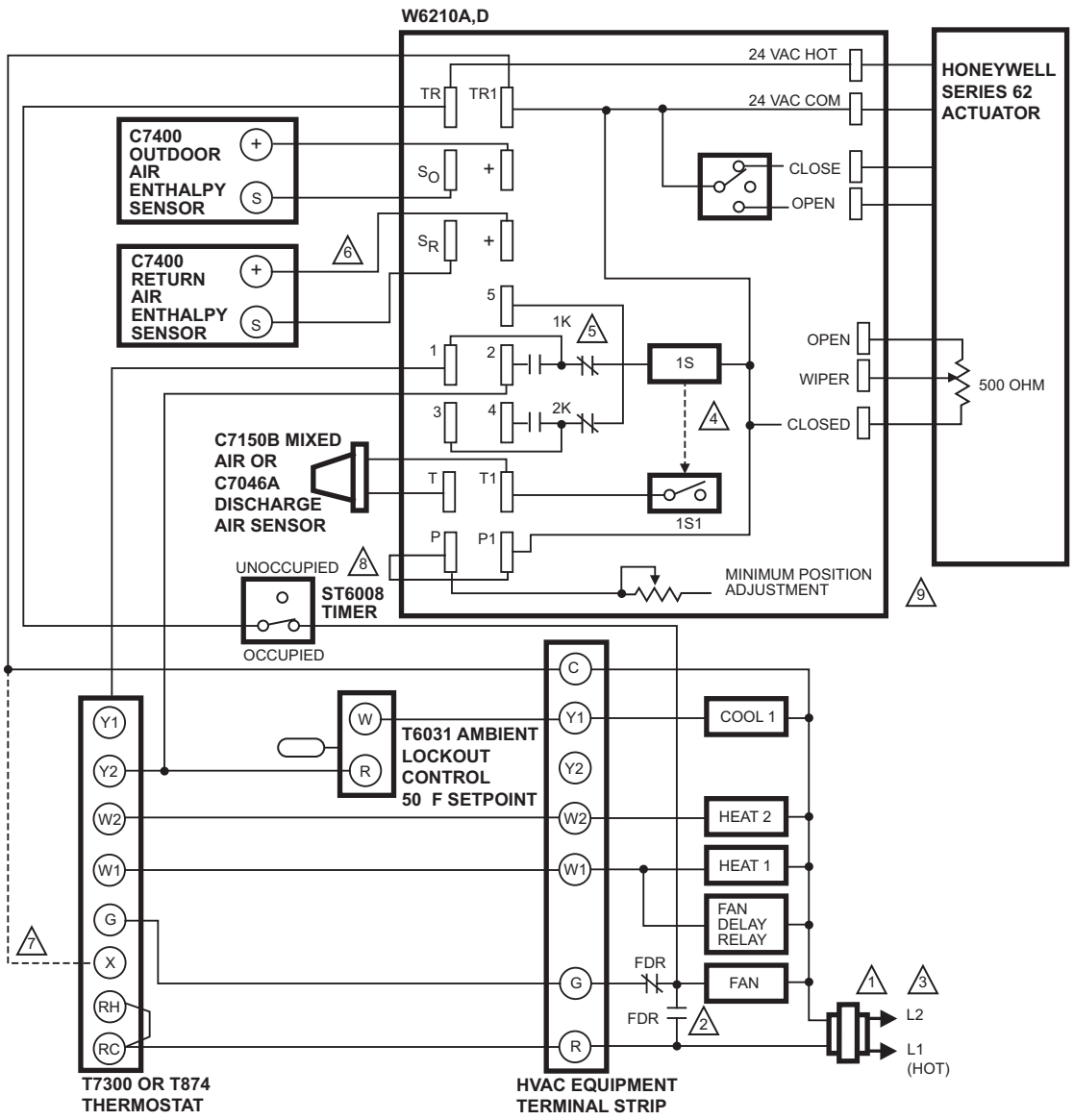
7 FOR T7300 ONLY.

8 FOR T7300, USE CONTACTS A 1AND A 2INSTEAD OF THE TIMER.

9 FOR THE ML7295A,C USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE, WHICH ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

M11152A

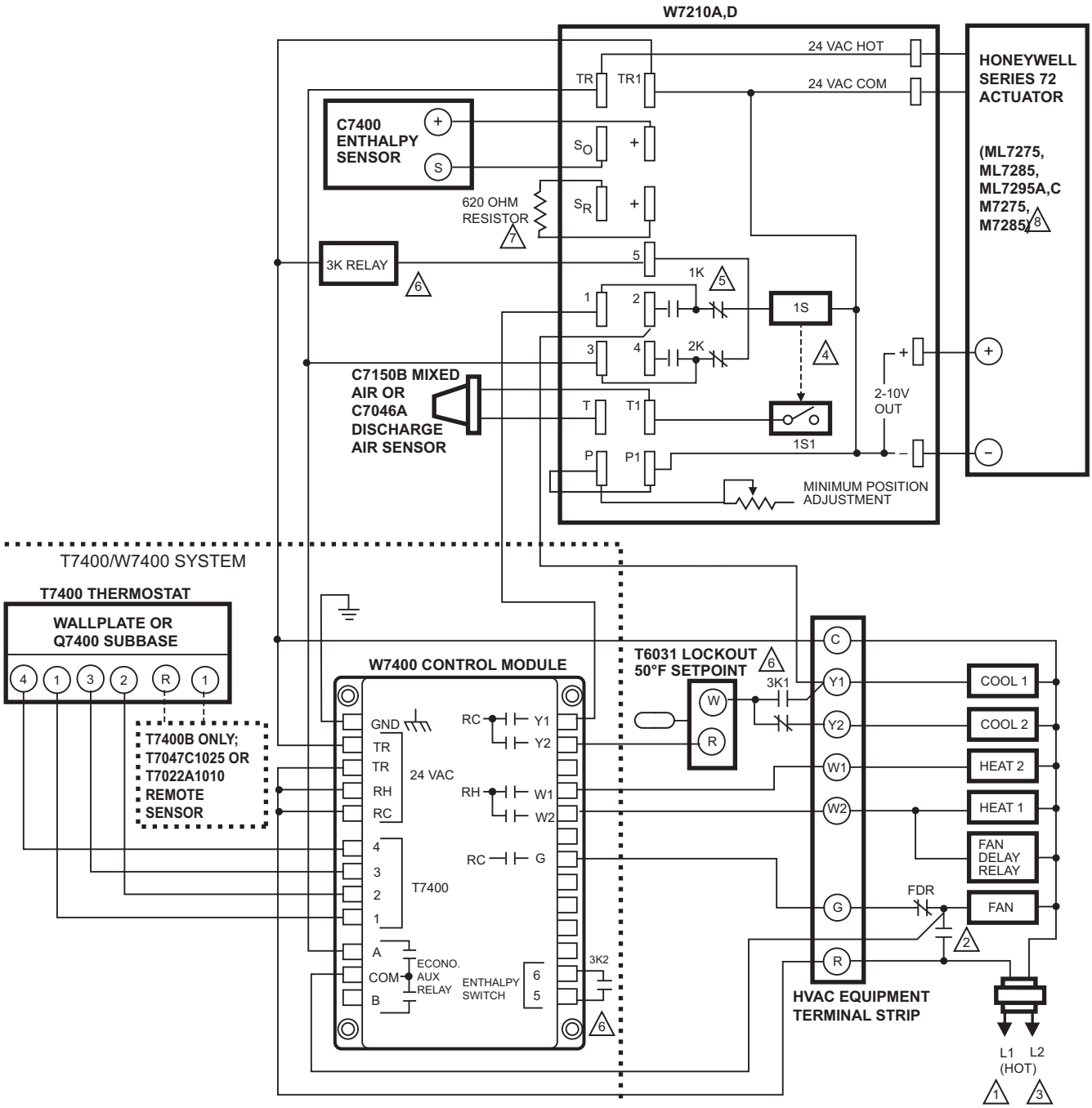
W7210A,D used in single-stage cooling system with single enthalpy changeover and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE OUTDOOR AIR ENTHALPY IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A 2 INSTEAD OF THE TIMER.
9. THE COMMON FOR THE W6210A,D IS DIFFERENT FROM THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH ONE TO A DIFFERENT CIRCUIT.

M11157C

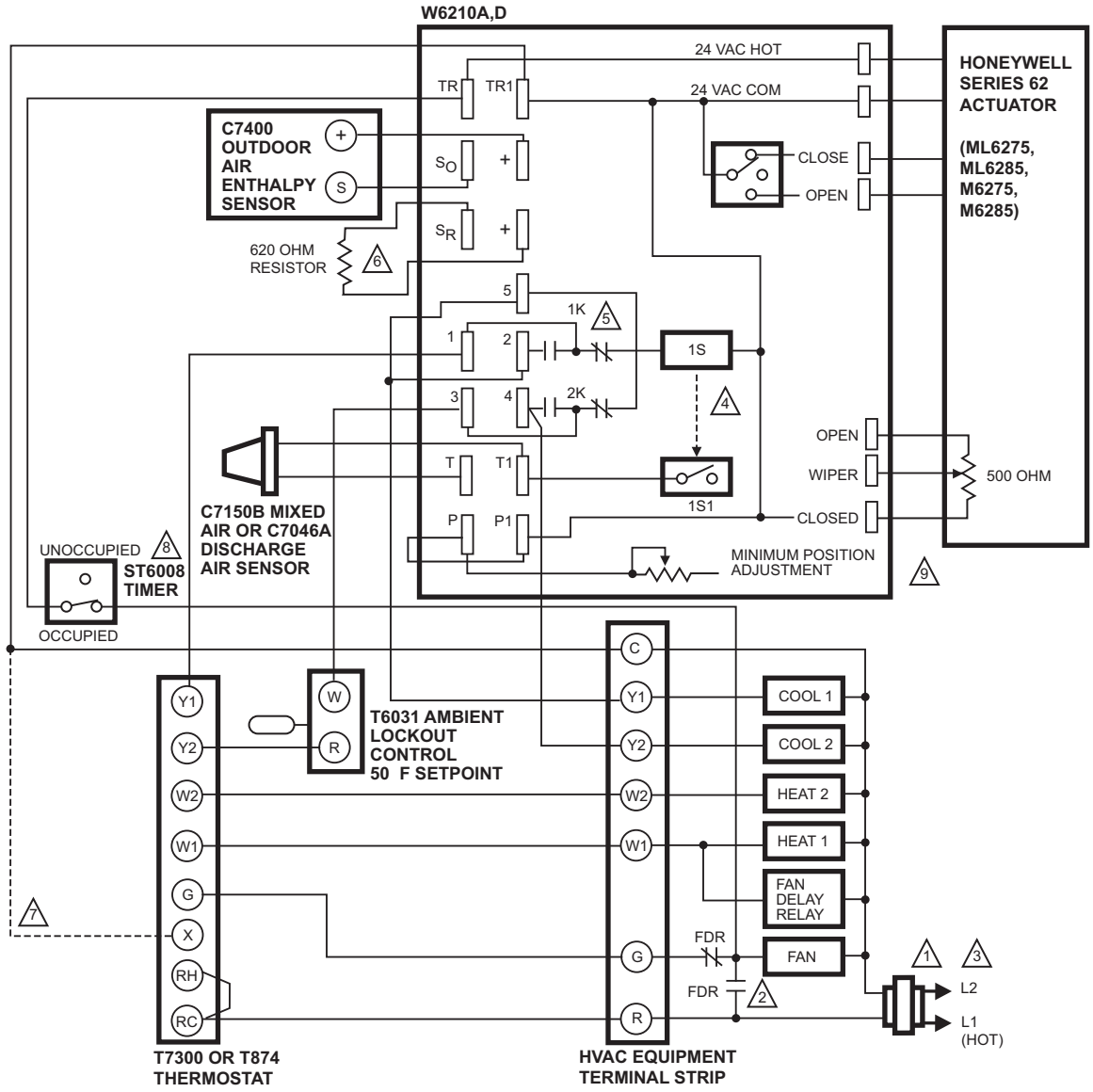
W6210A,D used in single-stage cooling system with differential enthalpy changeover and Honeywell Series 62 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. USE R8222N WITH PILOT DUTY CONTACTS FOR 3K. CONTACTS 3K1, 3K2 MAKE WHEN ENTHALPY IS BELOW SETPOINT AND ECONOMIZER IS USED FOR FIRST STAGE OF COOLING.
7. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

M11156A

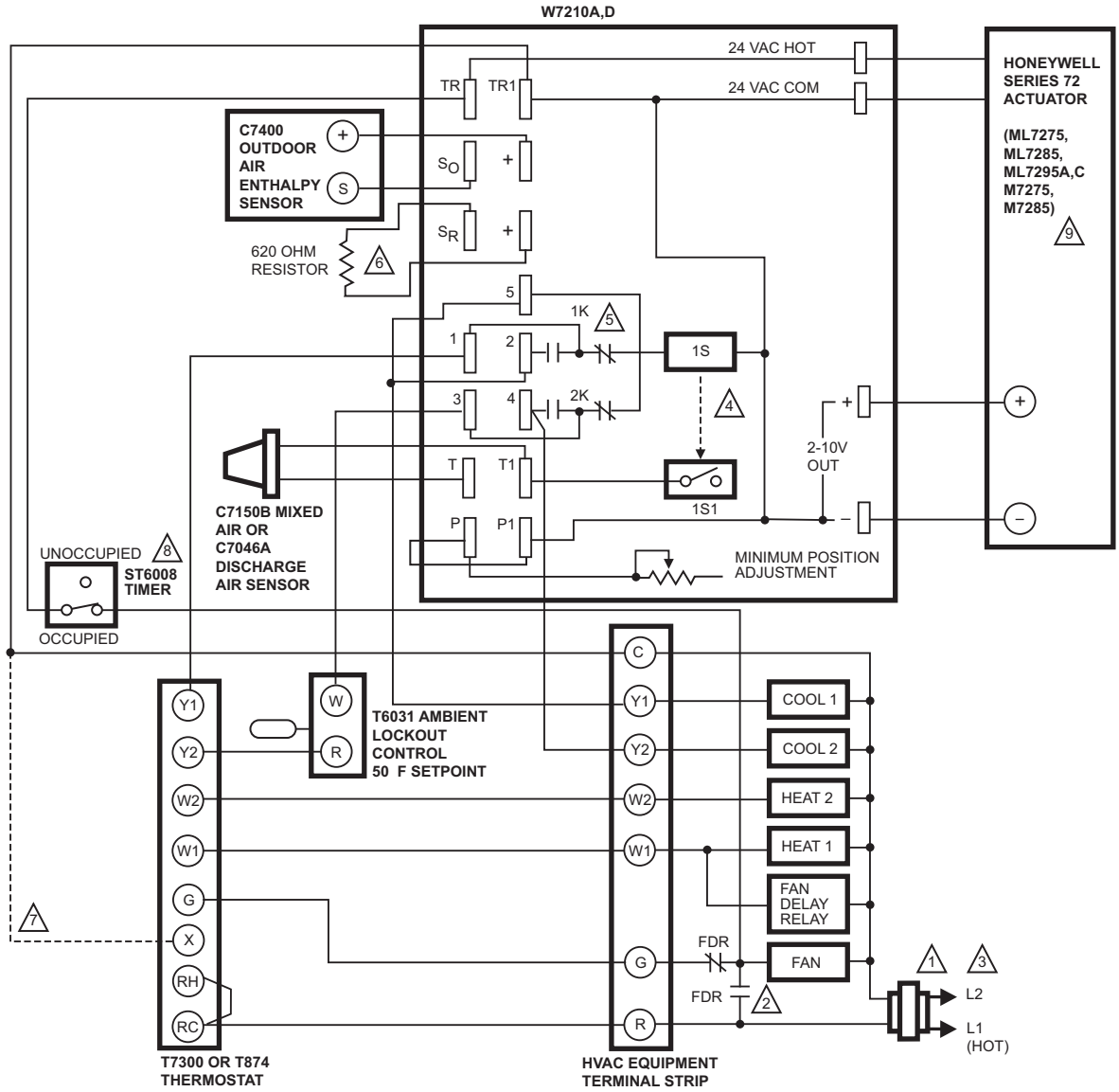
W7210A,D used with T7400/W7400 System and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A_1 AND A_2 INSTEAD OF THE TIMER.
9. THE COMMON FOR THE W6210A,D IS DIFFERENT FROM THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH ONE TO A DIFFERENT CIRCUIT.

M11153C

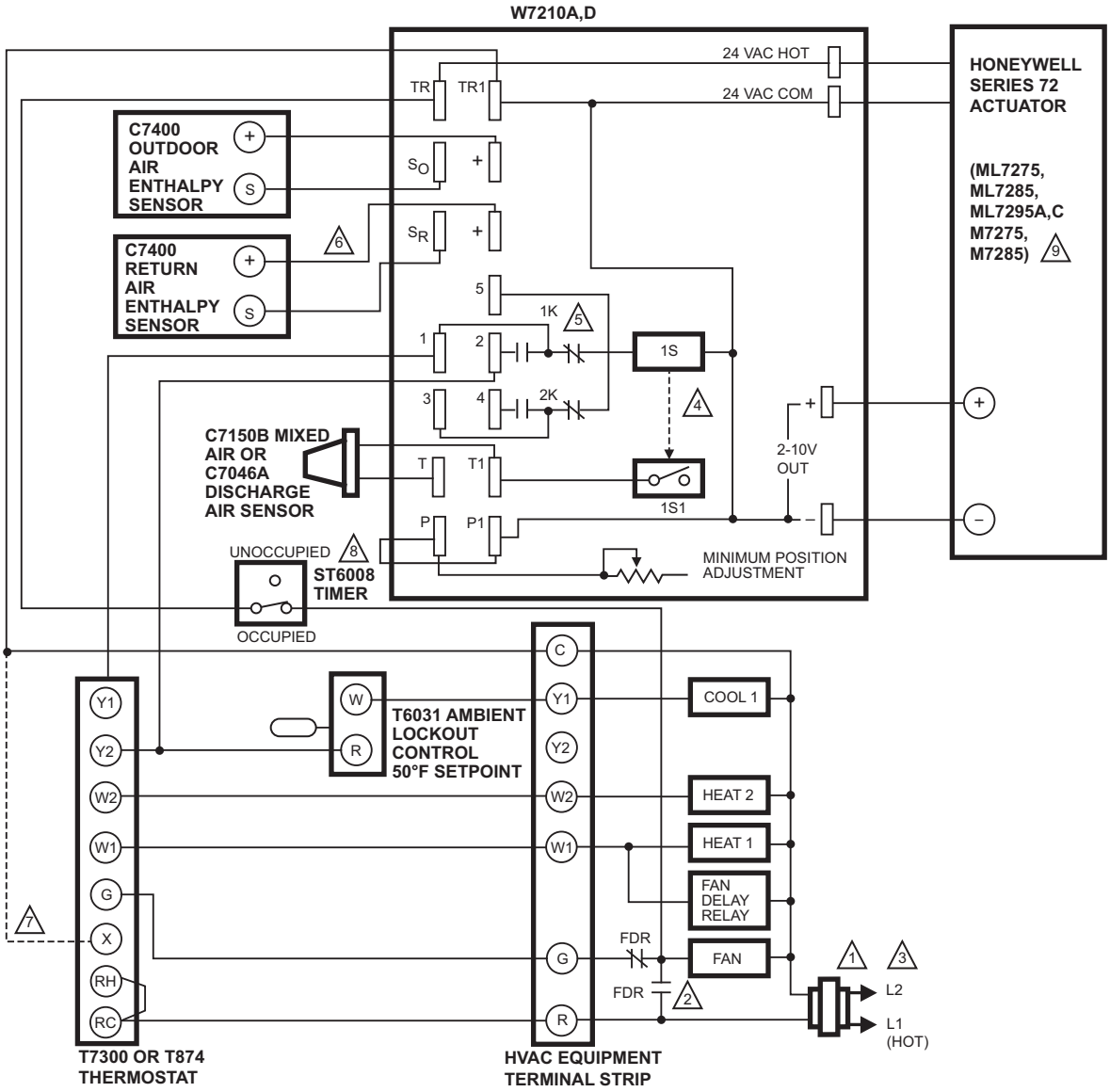
W6210A,D used in two-stage cooling system with single enthalpy changeover and Honeywell Series 62 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
9. FOR THE ML7295A,C USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE, WHICH ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

M11154B

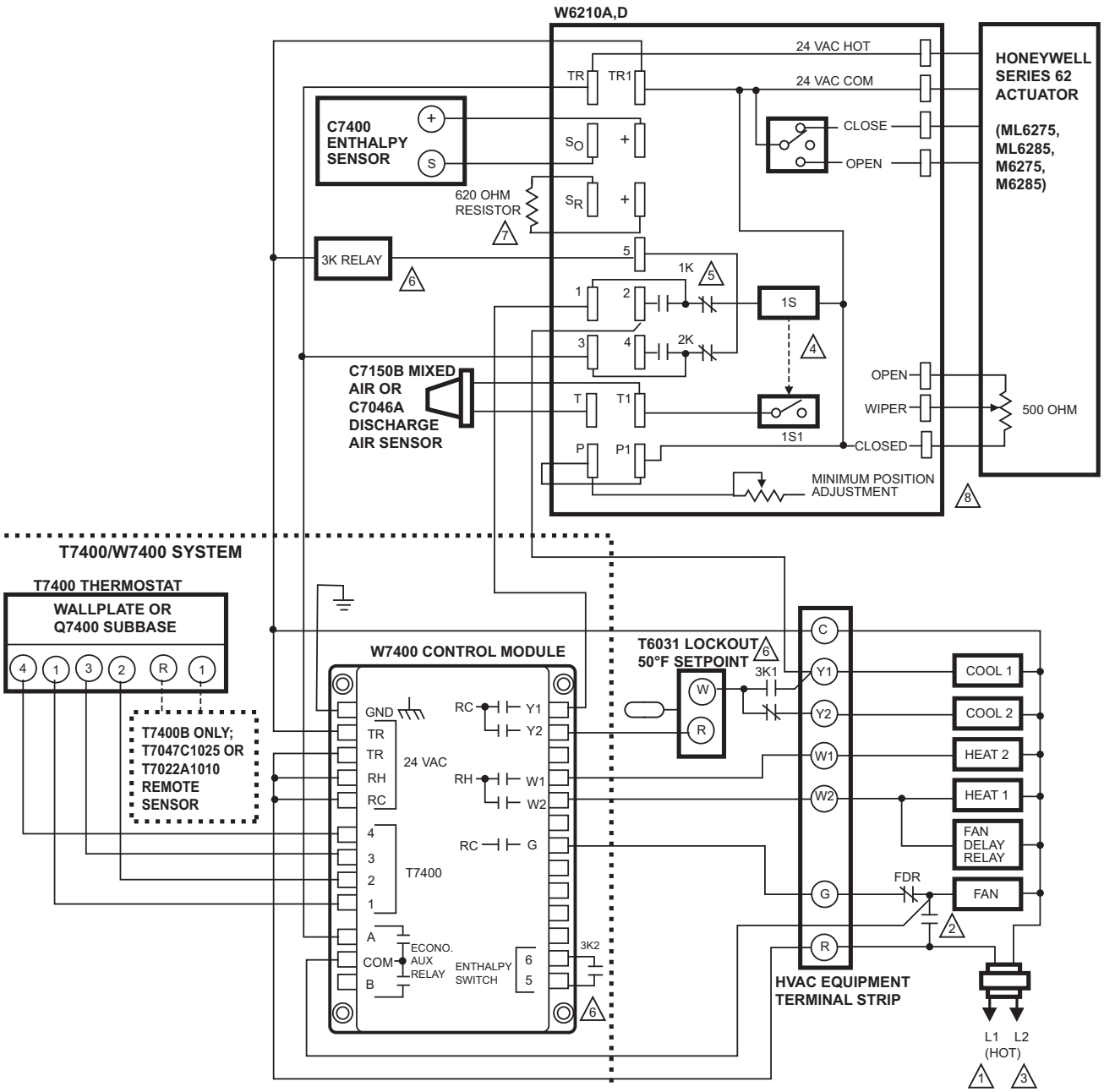
W7210A,D used in two-stage cooling system with single enthalpy changeover and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE OUTDOOR AIR ENTHALPY IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
9. FOR THE ML7295A,C USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE, WHICH ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

M11158A

W7210A,D used in single-stage cooling system with differential enthalpy changeover and Honeywell Series 72 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

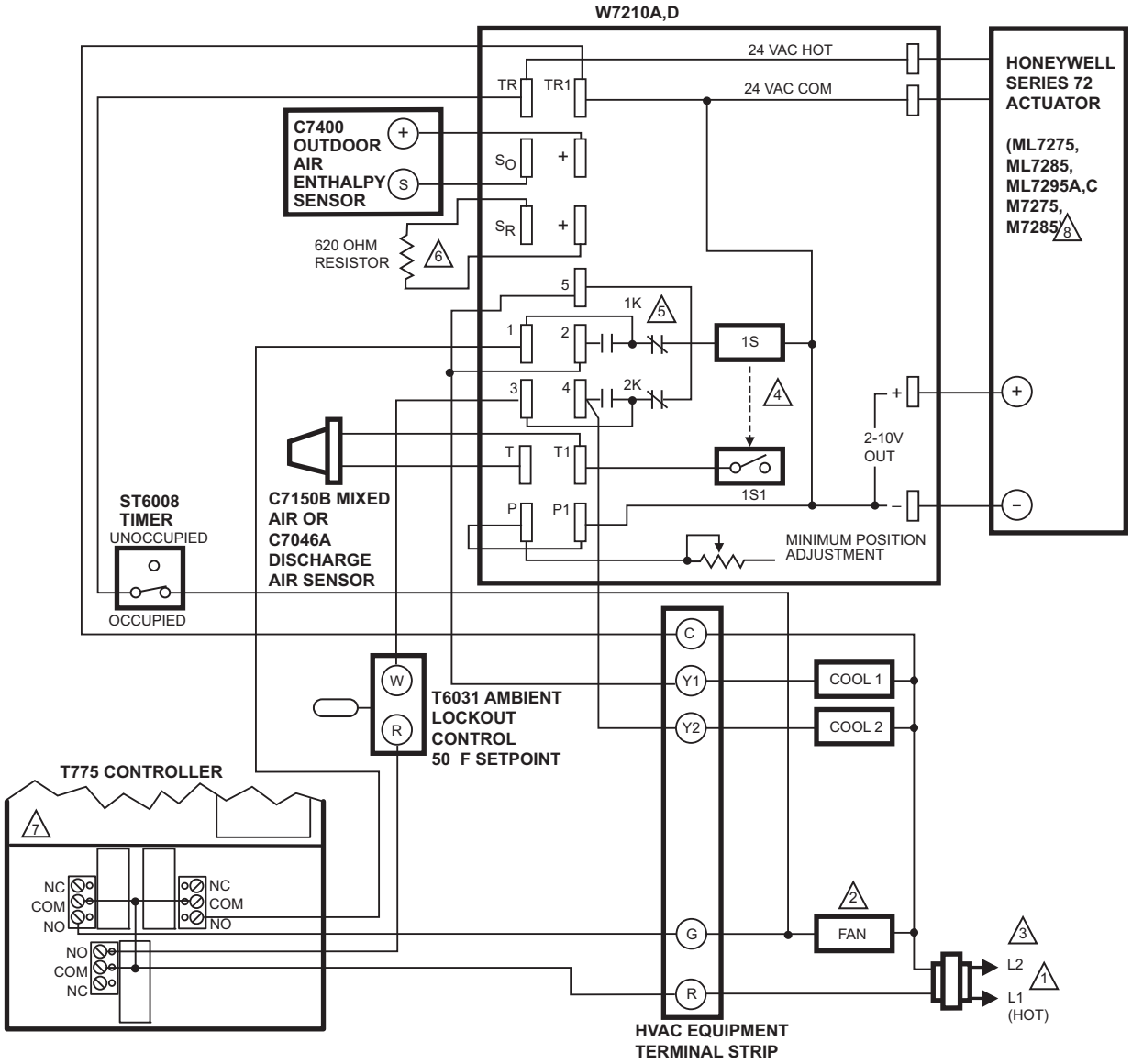
6 USE R8222N WITH PILOT DUTY CONTACTS FOR 3K. CONTACTS 3K1, 3K2 MAKE WHEN ENTHALPY IS BELOW SETPOINT AND ECONOMIZER IS USED FOR FIRST STAGE OF COOLING.

7 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

8 THE COMMON FOR THE W6210A,D IS DIFFERENT FROM THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH ONE TO A DIFFERENT CIRCUIT.

M11155C

W6210A,D used with T7400/W7400 System and Honeywell Series 62 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED FOR THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH, WHICH CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

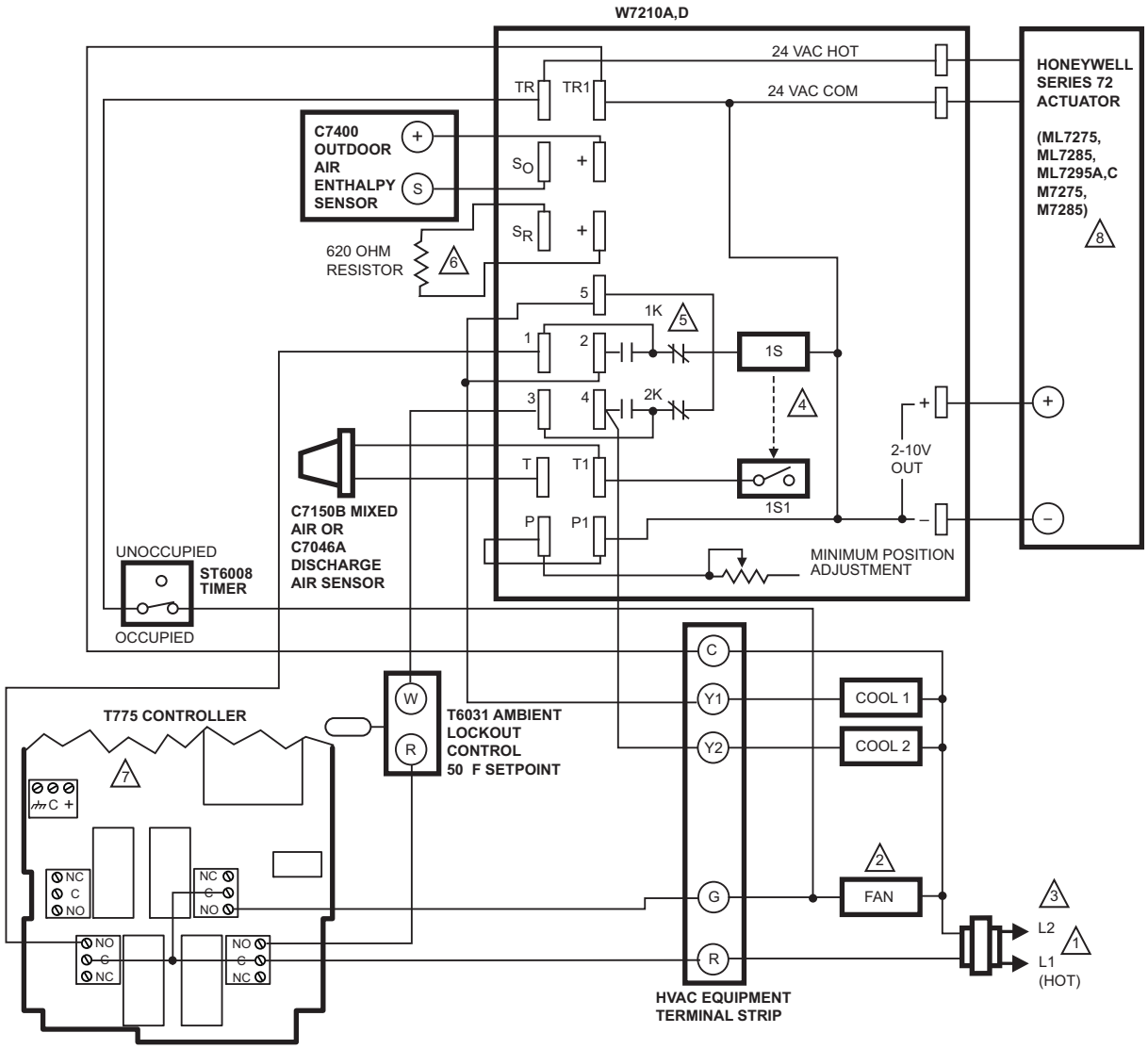
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL. A MAXIMUM OF ONE STAGE OF HEATING IS POSSIBLE WHEN THE SYSTEM IS WIRED IN THIS FASHION.

8 FOR THE ML7295A,C USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE, WHICH ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

M15298A

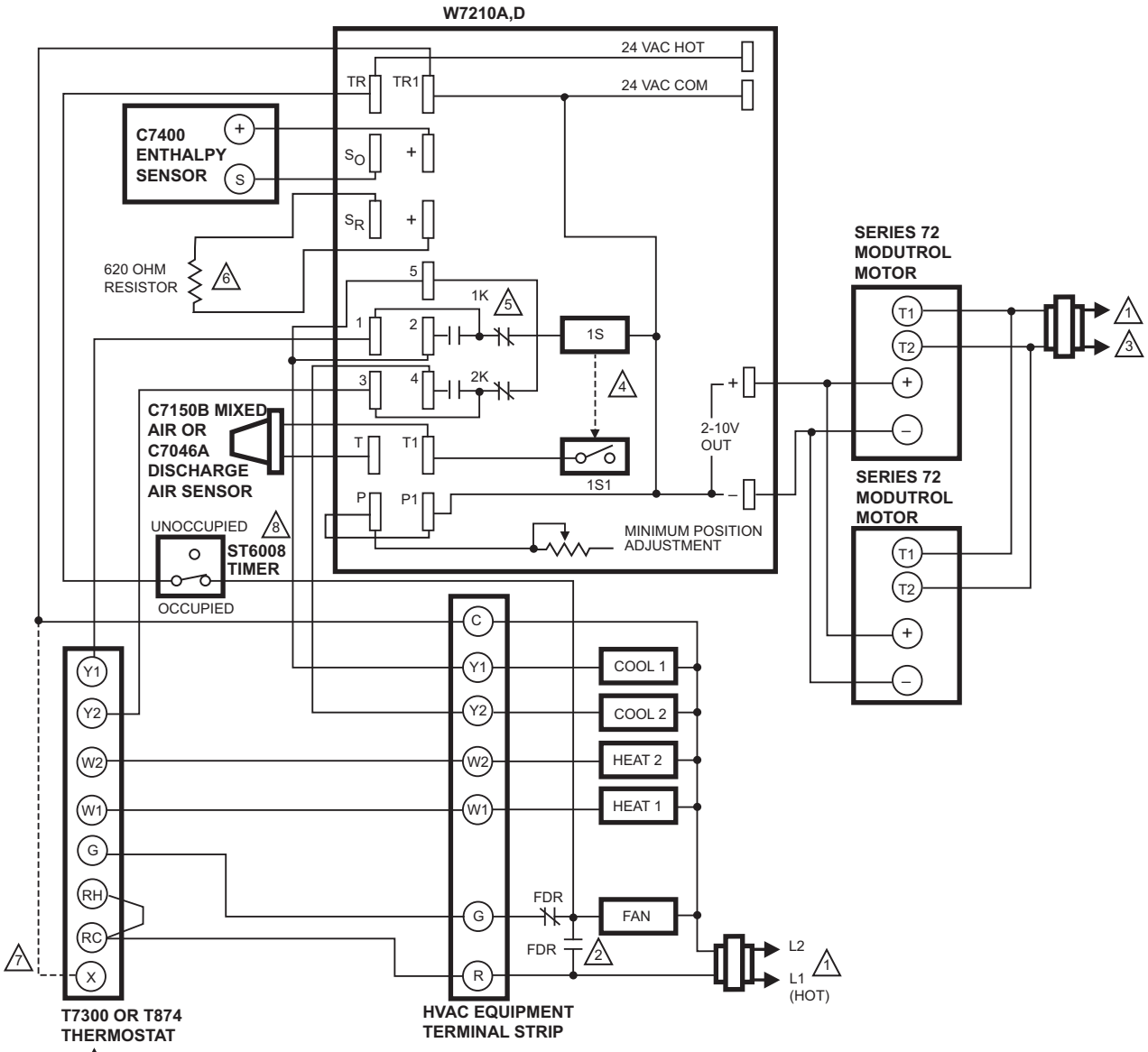
W7210A,D used with T775 Series 1000 Controller and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED FOR THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH, WHICH CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY IF A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL.
8. FOR THE ML7295A,C USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE, WHICH ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

M13844

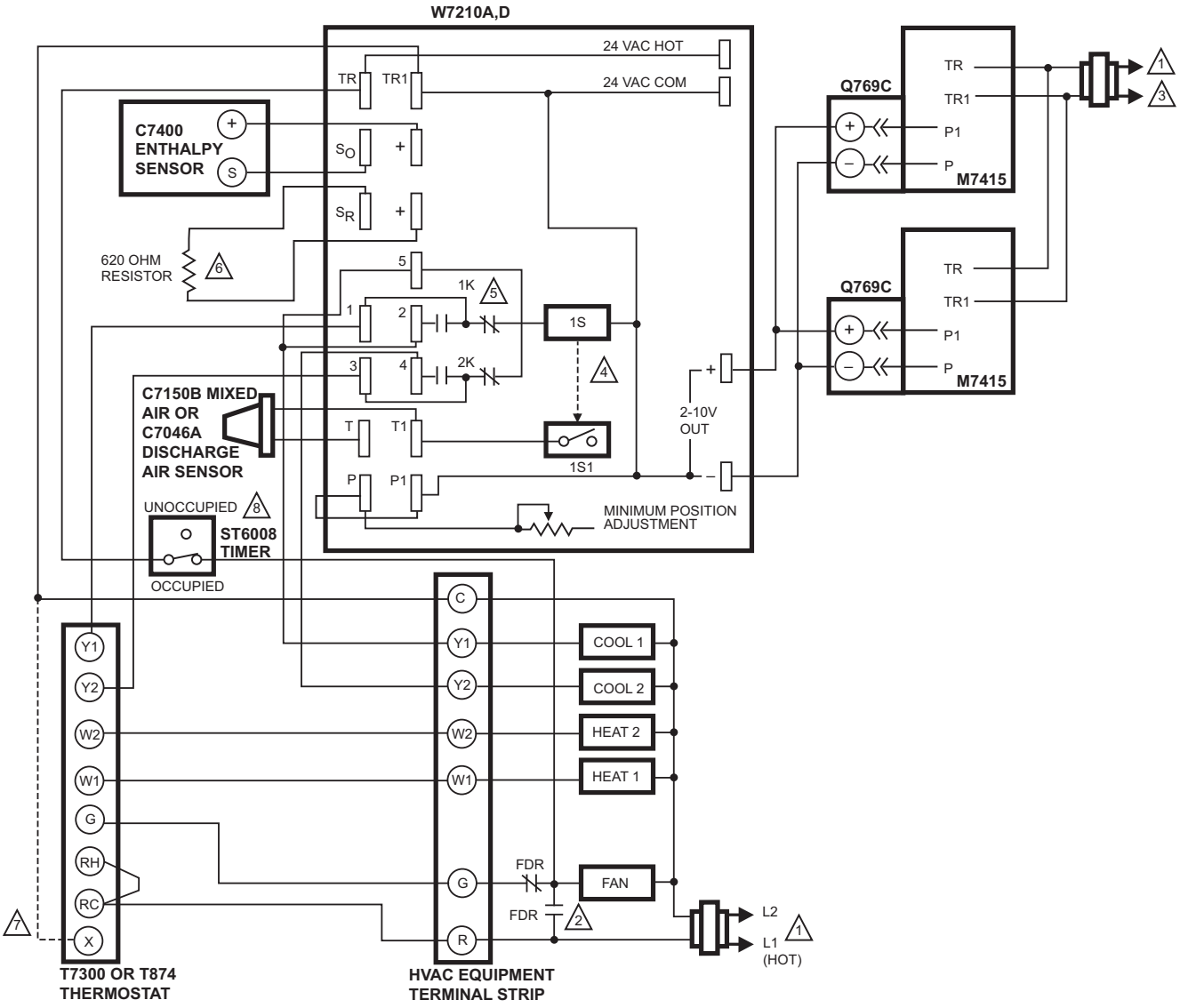
W7210A,D used with T775 Series 2000 Controller and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE LOAD OF ALL ACTUATORS.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A 2 INSTEAD OF THE TIMER.

M15300

W7210A,D controlling parallel wired Honeywell Series 72 Modutrol™ Motors



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

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4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.

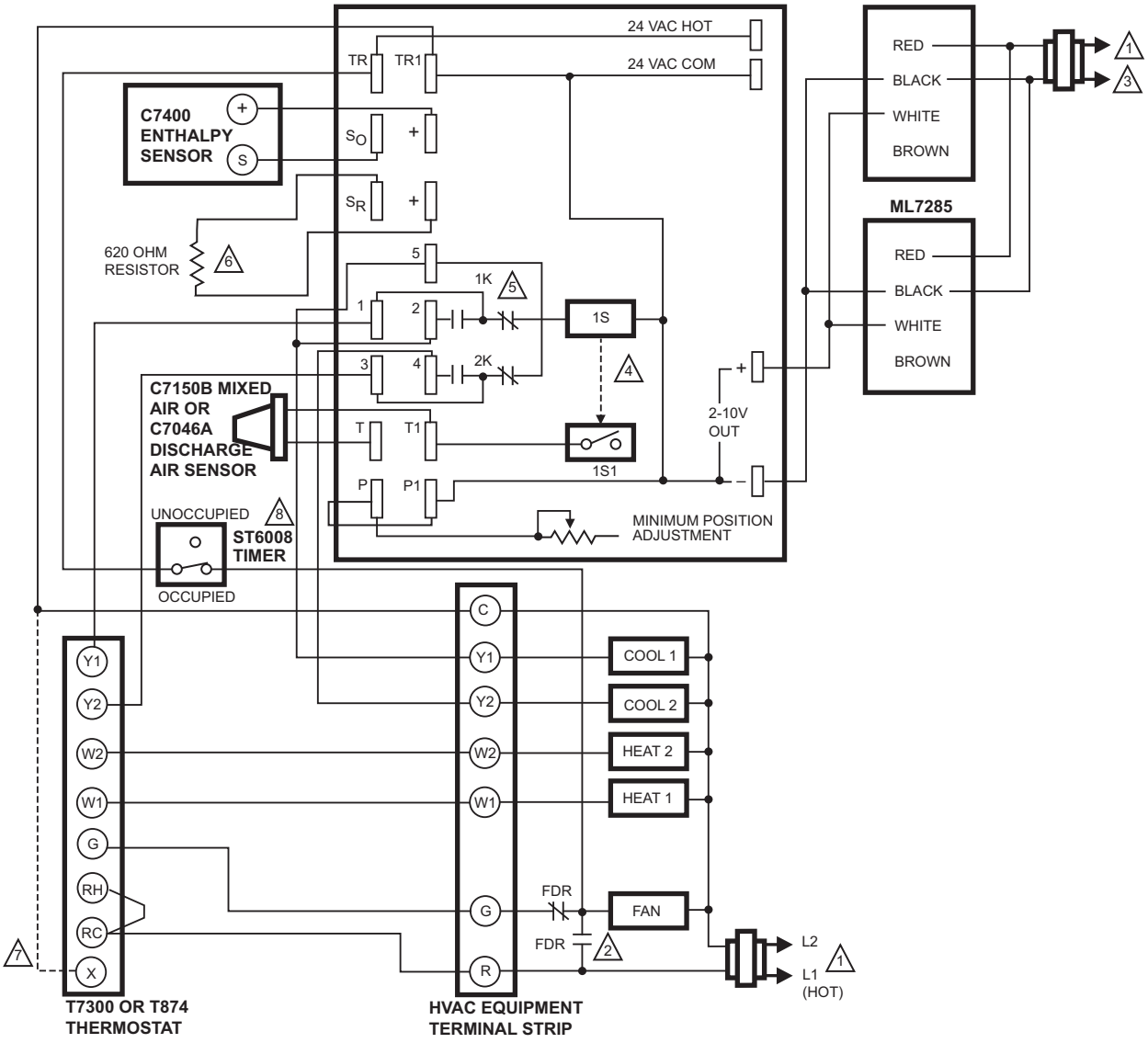
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.

7 FOR T7300 ONLY.

8 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

M15301

W7210A,D controlling parallel wired M7415 Economizer Motors



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE LOAD OF ALL ACTUATORS.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. RELAYS 1K AND 2K ACTUATE WHEN THE ENTHALPY SENSED BY THE C7400 IS HIGHER THAN THE ENTHALPY SETPOINT A-D.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE STAGE COOLING THERMOSTAT.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

M15299

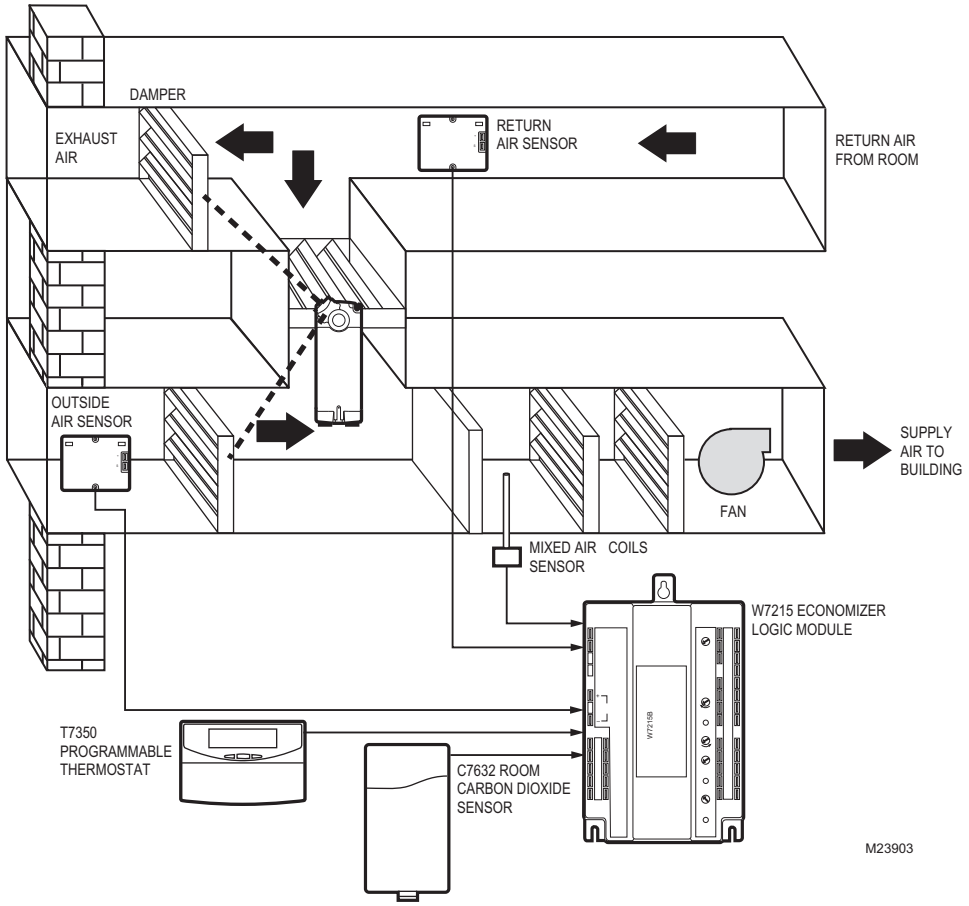
W7210A,D controlling parallel wired Honeywell Series 72 Direct Coupled Actuators

Section 6 - W6210 And W7210 Economizer Modules

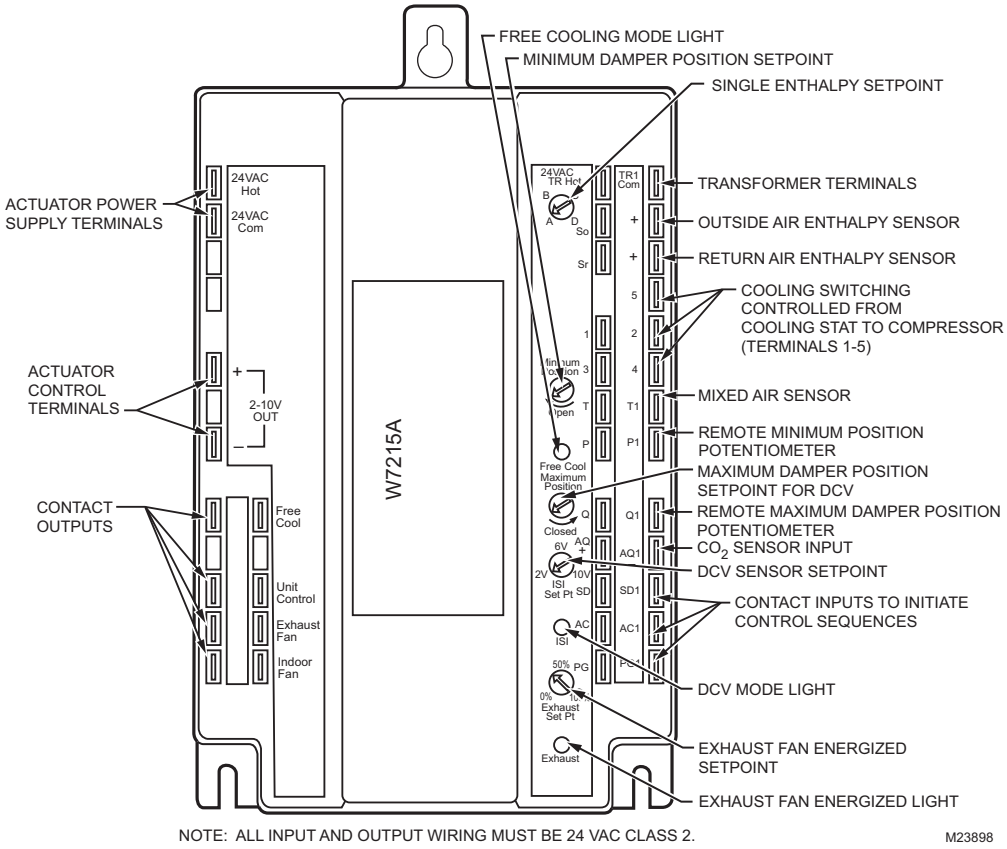
Section 7 - W6215, W7215 And W7460 Economizer Modules

WITH AIR CONTENT SENSOR INPUTS

W7215 System Components



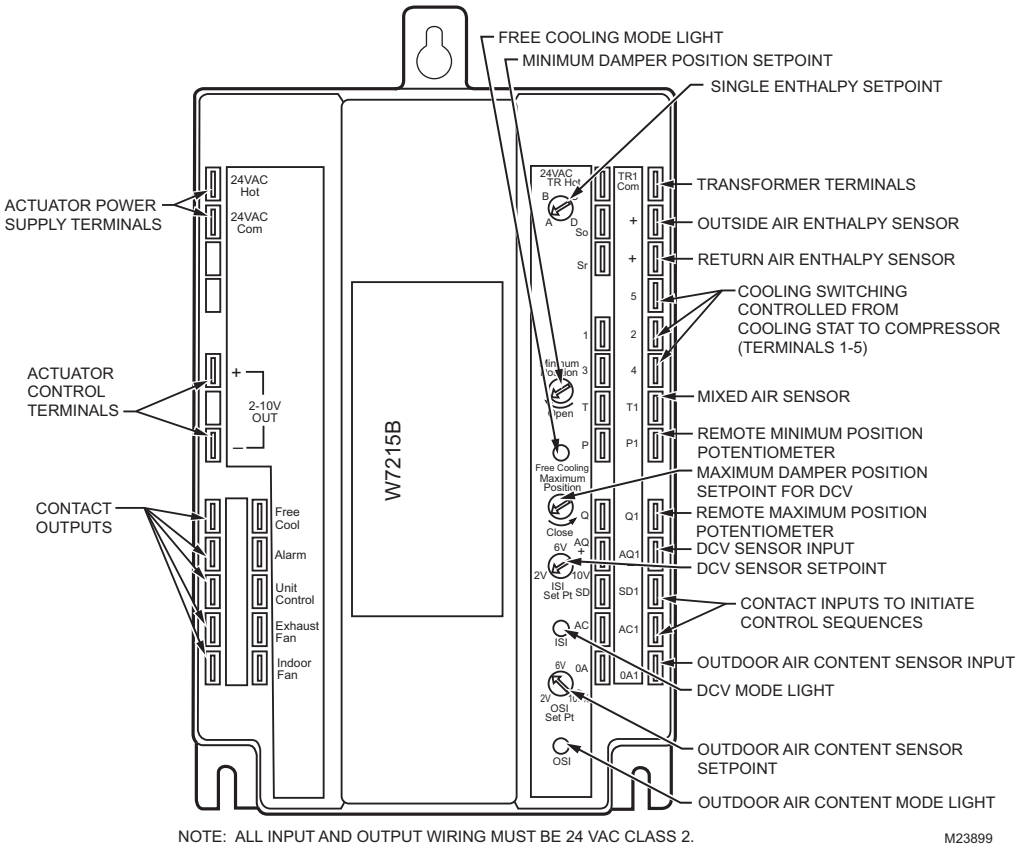
W6215, W7215 and W7460 Components



NOTE: ALL INPUT AND OUTPUT WIRING MUST BE 24 VAC CLASS 2. M23898

The W7215A is an economizer module for use with series 72 actuators. The W7215B is similar except for an outside air content sensor input and slightly different contact inputs and outputs. The W6215A is for use with series 62 actuators but otherwise identical to the W7215A. The W7460A is for use with the M7415 actuator. The W7460B is similar to the A except for an outside air content sensor input and slightly different contacts.

W7215B and W7460B Components

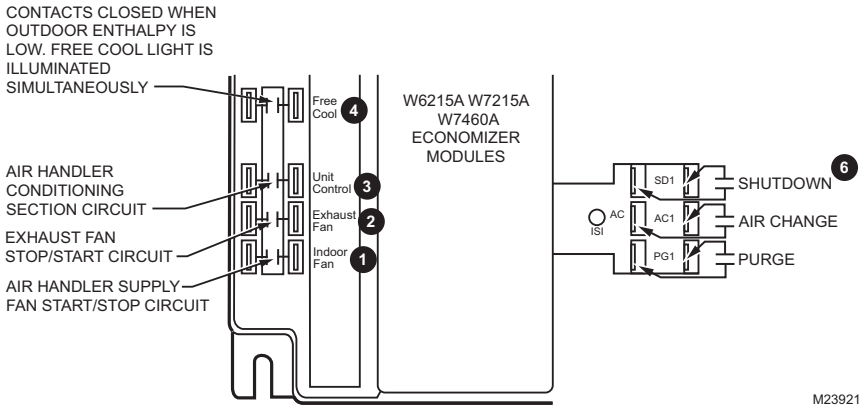


The W7215B and W7460B are equipped with outdoor air content sensor inputs. There are slight variations to the input and output terminals:

- The purge function is eliminated.
- An alarm contact output is added for when the indoor DCV and outdoor air content setpoints are simultaneously exceeded. Refer to page 91.
- The exhaust fan setpoint and exhaust indication light are eliminated.
- An outdoor air content sensor setpoint and indication light are added.

W6215, W7215, W7460 Inputs and Outputs

Contact Outputs



Indoor Fan Contacts
Contacts are made when the Air Change contacts are made (AC and AC1) **1**

Exhaust Fan Contacts
The Contacts are made when:
The Purge Contacts (PG and PG1) are made
or
The Air Change Contacts are made (AC and AC1) **2**

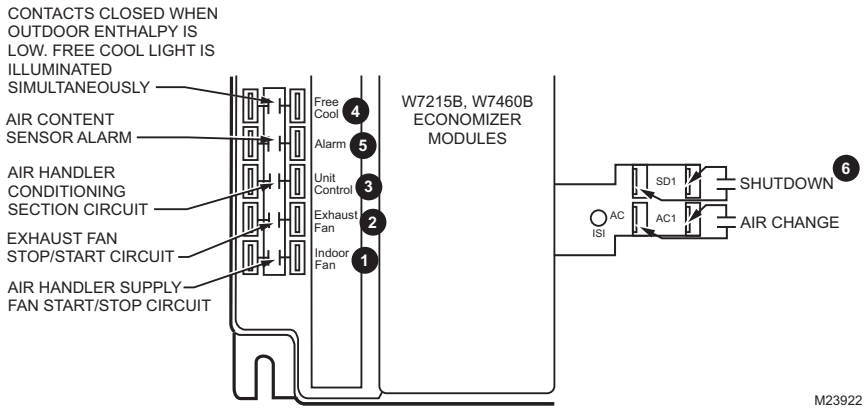
Unit Control Contacts
The Contacts are made when the panel is powered except during shutdown Air change or Purge **3**

Free Cooling Contacts
Contacts are made with the unit is in the Economizer mode **4**

Alarm Contacts
Contacts are made when both indoor and outdoor Air content setpoints are exceeded **5**

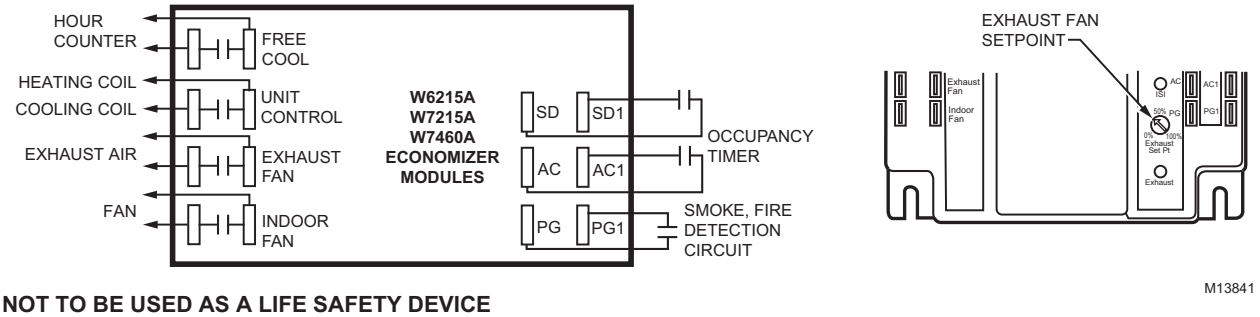
Contact Inputs

Input Contacts
Can be made with time based controls or manually using a relay or jumper **6**



This series of economizer modules includes input and output contacts for use in controlling the fans and conditioning equipment on the air handler. Some of these contacts are not available on all modules.

Input and Output Applications



NOT TO BE USED AS A LIFE SAFETY DEVICE

Free Cool Contacts

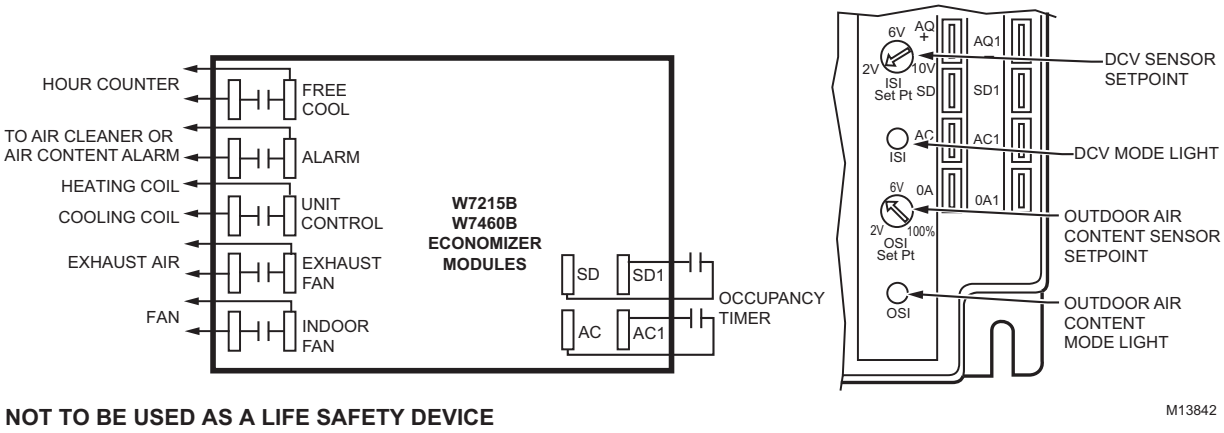
Free Cool Contacts are made when the unit is in the economizer mode. This allows connection of a timer to the logic modules to track the hours available for free cooling **NOT** the number of actual cooling hours. Actual hours of cooling can be logged using the contact closure from the commercial thermostat.

Exhaust Fan Setpoint

Exhaust Fan Setpoint is the option to set the actual outside air damper position when the Exhaust Fan is powered through a set of contacts. The unit has an approximate 45 second delay from the time the indoor air sensor calls for the fan and when the fan is energized to allow the outside air damper to reach the position. This prevents placing an extra load on the fan by running it when the outside dampers are closed.

Purge Contacts

When the Purge Contacts are connected with a jumper or relay closure the outside air dampers close, the exhaust fan contacts are made and the contacts to the indoor fans and unit control are opened. This allows the building manager to exhaust smoke from the building but not add outside air.



NOT TO BE USED AS A LIFE SAFETY DEVICE

Shutdown Contacts

When the Shutdown Contacts are connected with a jumper or relay closure, the outside dampers close, and the contacts to the exhaust and indoor fans and unit control are opened turning all systems off. This allows the building manager to shut down all systems from one contact closure.

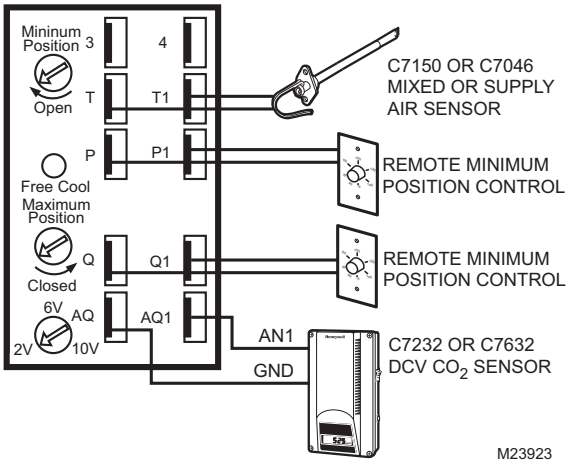
Air Change Contacts

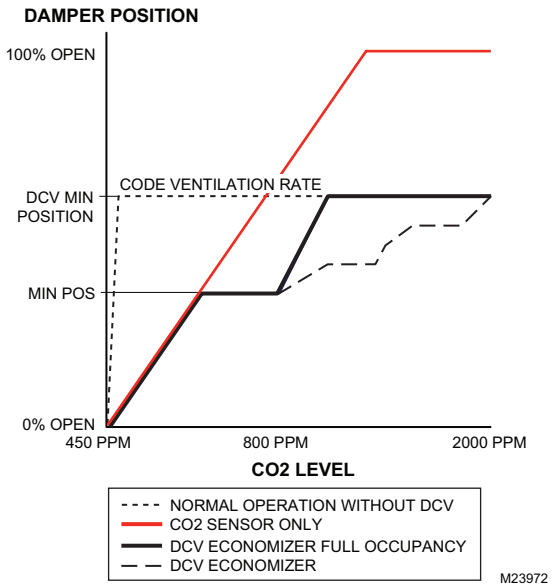
When the Air Change Contacts are connected with a jumper or relay closure, the outside dampers open, and the contacts to the exhaust and indoor fans are made. This option allows the building manager to change the air in the building before occupancy or before an event when the space will be full, as in a theater before the movie begins.

Alarm Contacts

Alarm Contacts only available on B models with outdoor air content sensors. Contacts are made when both indoor (DCV) and outdoor content sensor values exceed their respective setpoints. These contacts can be used to initiate visual or audible annunciation of an air content alarm or to turn on an air cleaner.

Minimum and Maximum Settings



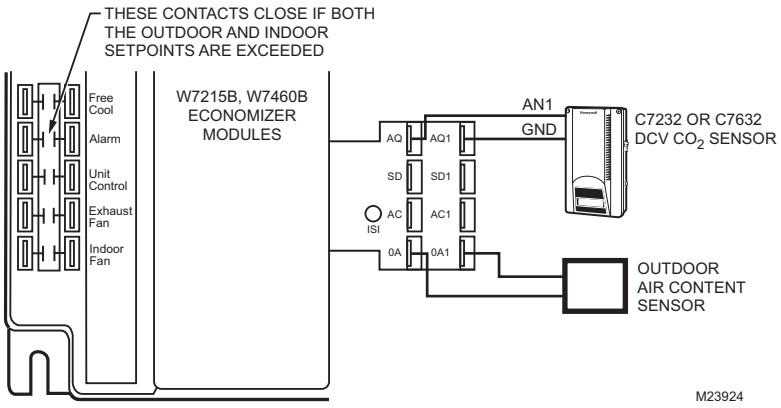


This series of economizer modules includes both minimum and maximum damper position settings. Previous economizer controls are equipped with only a minimum setting to maintain a volume of outside air for ventilation. The minimum setting on these modules is to ventilate for the building components when using DCV or to ventilate for cfm per person for maximum occupancy when not using DCV. The maximum setting is used to limit the amount of outside air brought into the air handler.

When using DCV, this is the sum of the ventilation for the building components and the maximum design human occupancy. See above for control of dampers using DCV and minimum and maximum damper positions. When DCV is not used this setting can be used to limit the amount of outside air brought into the system.

If the dampers are being modulated from the mixed air sensor as the first stage of cooling from the commercial thermostat, the DCV maximum setting is not in the circuit and the dampers can be opened fully as needed. If the dampers are being modulated from both the mixed air sensor and the DCV sensor, the dampers will be opened to whichever is a higher signal. If the mixed air temperature decreases below 40°F (4°C) the signal from the DCV sensor is ignored and the dampers are modulated toward closed to prevent freezing of coils and other equipment in the air handler.

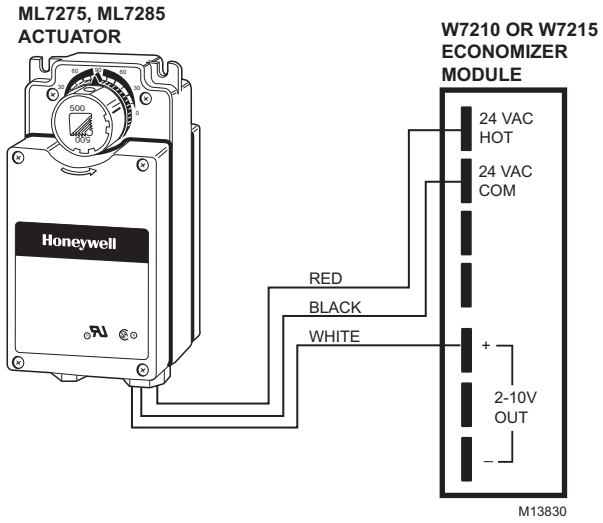
Outdoor Air Content Sensor

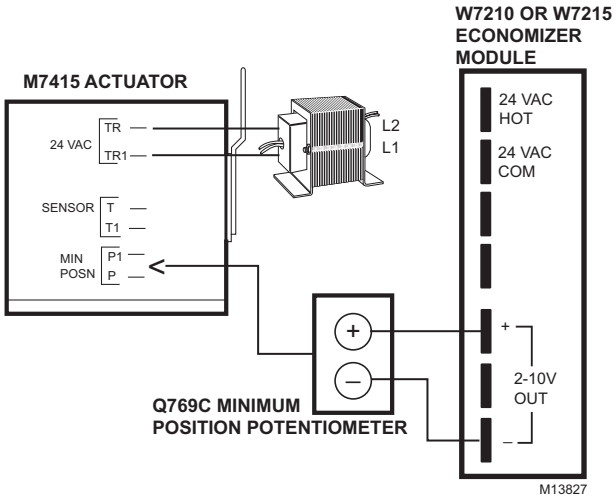


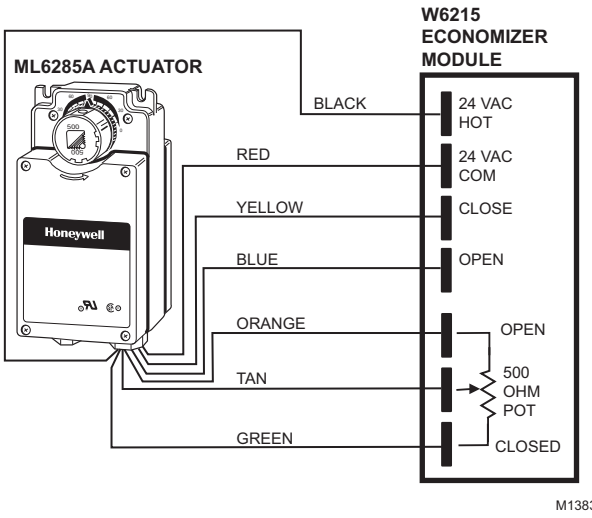
Outdoor Air Content Sensor	DCV	Mixed Air Damper Actuator	Outdoor Air Content Sensor Light	Alarm Contacts
Below Setpoint	Below Setpoint	Modulation based on signal from mixed air temperature sensor.	Off	Open
	Above Setpoint	Modulation between minimum and maximum positions based on signal from either mixed air or indoor air content sensors, whichever signal is higher.	Off	Open
Above Setpoint	Below Setpoint	Closed fully.	On	Open
	Above Setpoint	Modulation based on signal from mixed air temperature sensor. Terminals labeled Alarm made to energize warning light, audio alarm or air cleaner.	On	Made

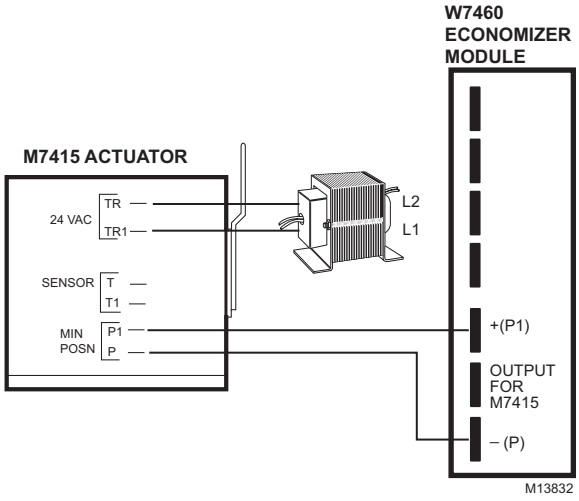
The purpose of the DCV sensor is different from that of the outdoor air content sensor. On the economizer modules equipped with outdoor air content sensors the purpose of the sensor is to keep the outside air dampers at a minimum position if the outdoor air is above its setpoint threshold. Alarm contacts on the economizer module will close if both the outdoor and indoor air (DCV) signals are above their respective setpoint thresholds.

W6215, W7215 and W7460 Actuator Usage



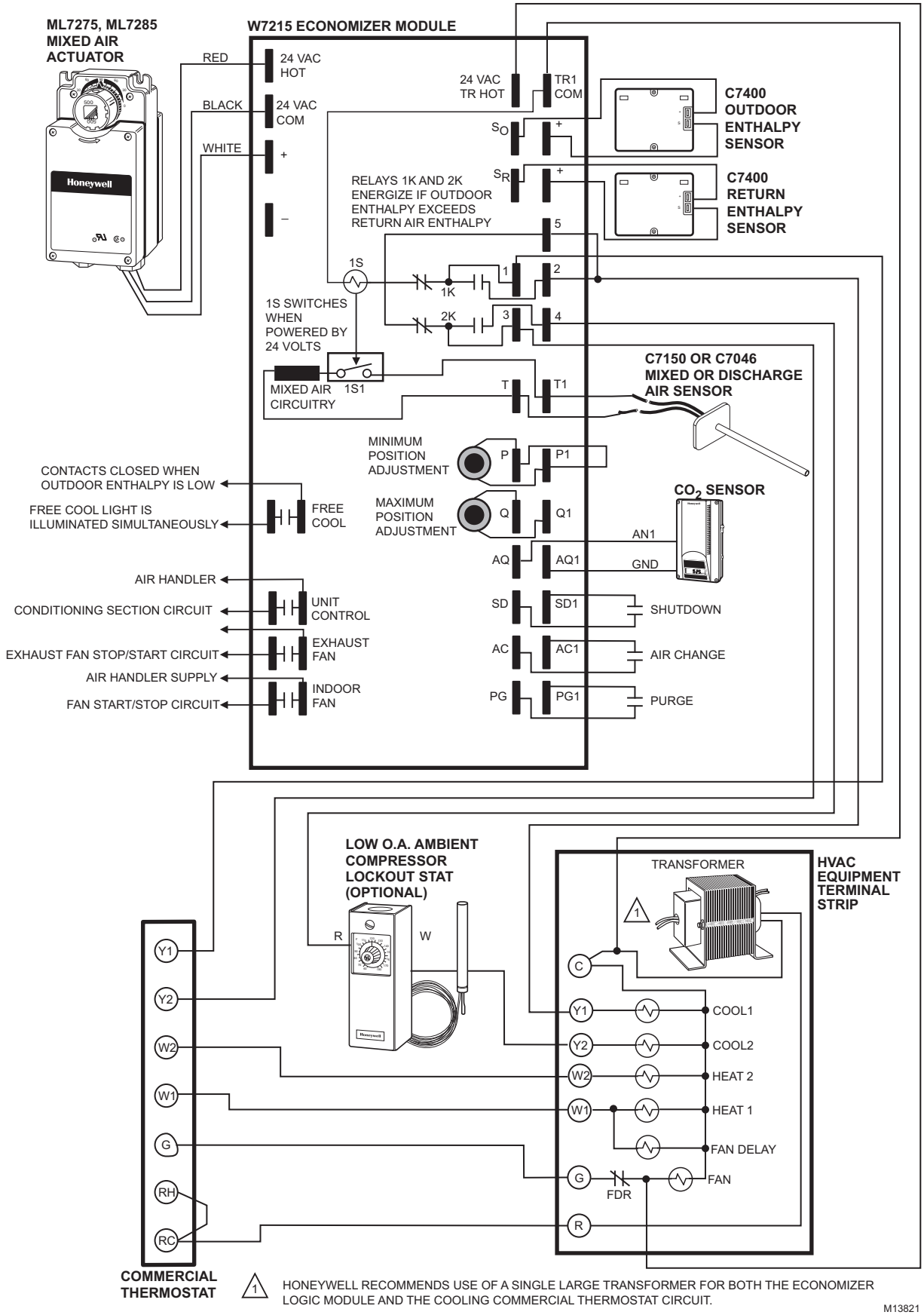


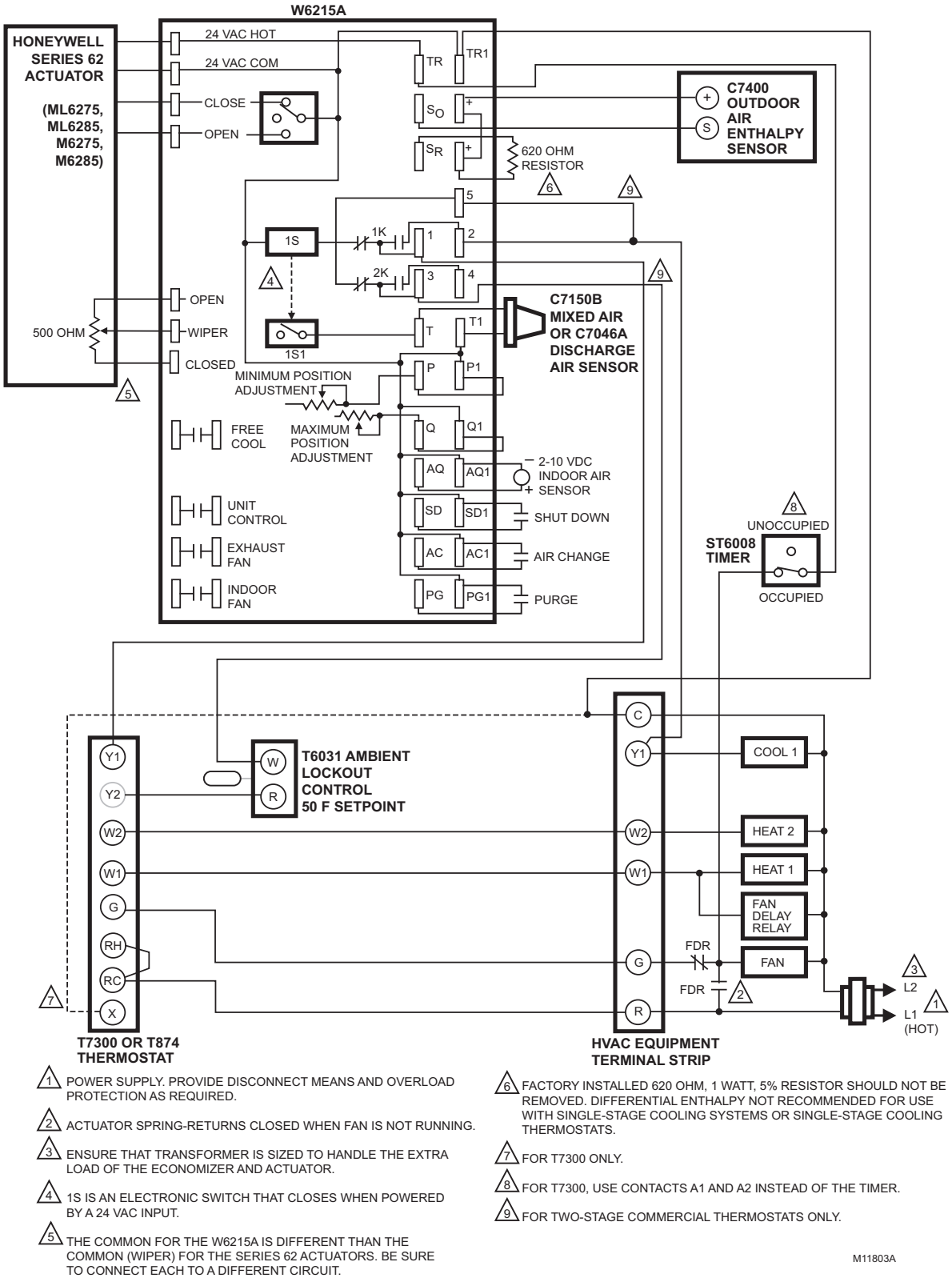




The W7460 can only be used with the M7415 actuator. The W7215 can be used with series 72 actuators (Direct Coupled Actuators, M7215 and Modutrol motors) and the M7415, when a Q769C potentiometer is used to adapt to the 2 to 10 Vdc signal to the M7415. The W6215 is only usable with series 62 actuators. Refer to Section 5 on W6210 and W7210 economizer modules for more information on parallel and ML7295H actuator connections.

W6215, W7215 and W7460 Wiring Diagram





1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 THE COMMON FOR THE W6215A IS DIFFERENT THAN THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH TO A DIFFERENT CIRCUIT.

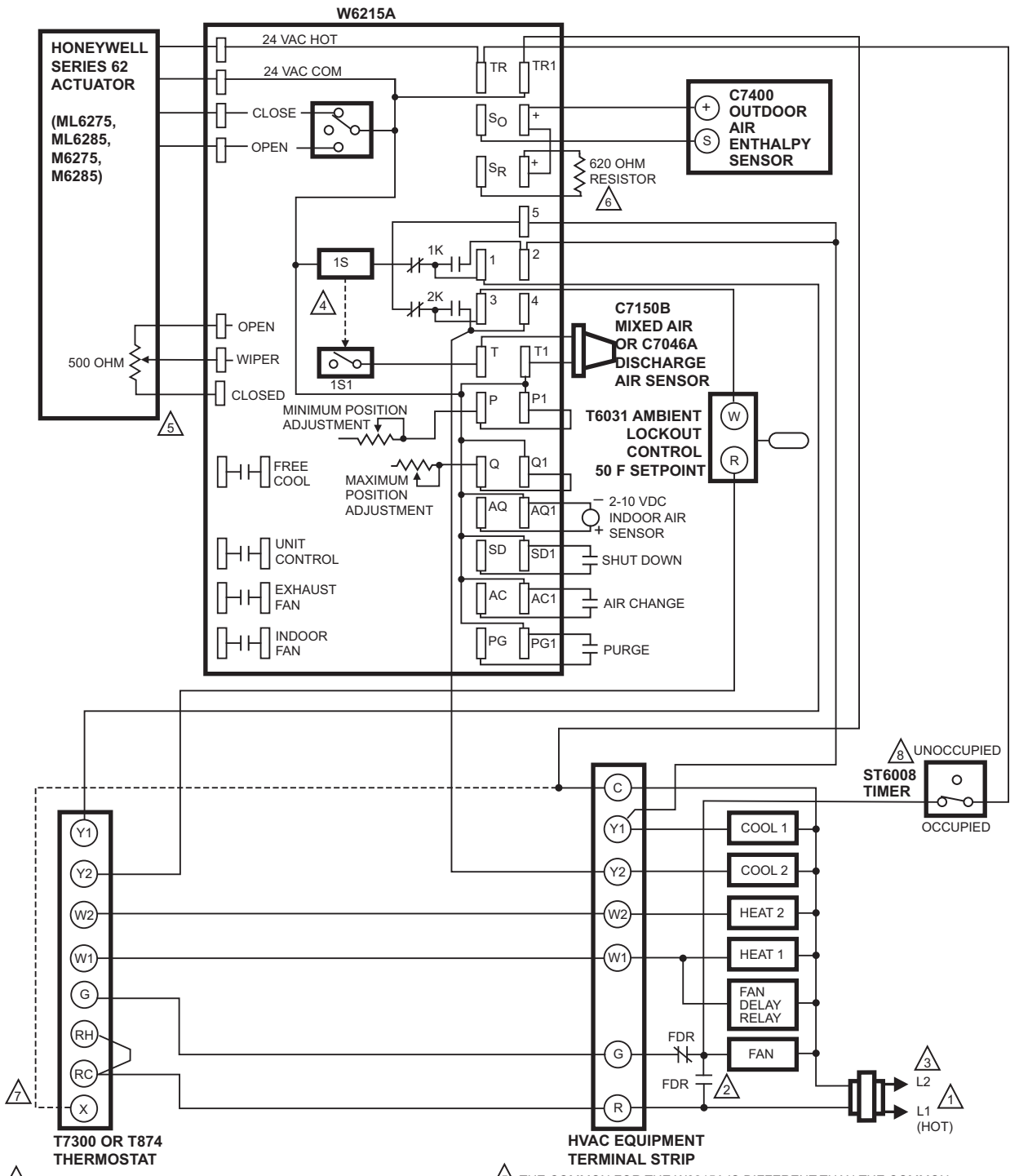
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.

7 FOR T7300 ONLY.

8 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

9 FOR TWO-STAGE COMMERCIAL THERMOSTATS ONLY.

W6215A used in single-stage cooling system with single enthalpy changeover and Honeywell Series 62 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 THE COMMON FOR THE W6215A IS DIFFERENT THAN THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH TO A DIFFERENT CIRCUIT.

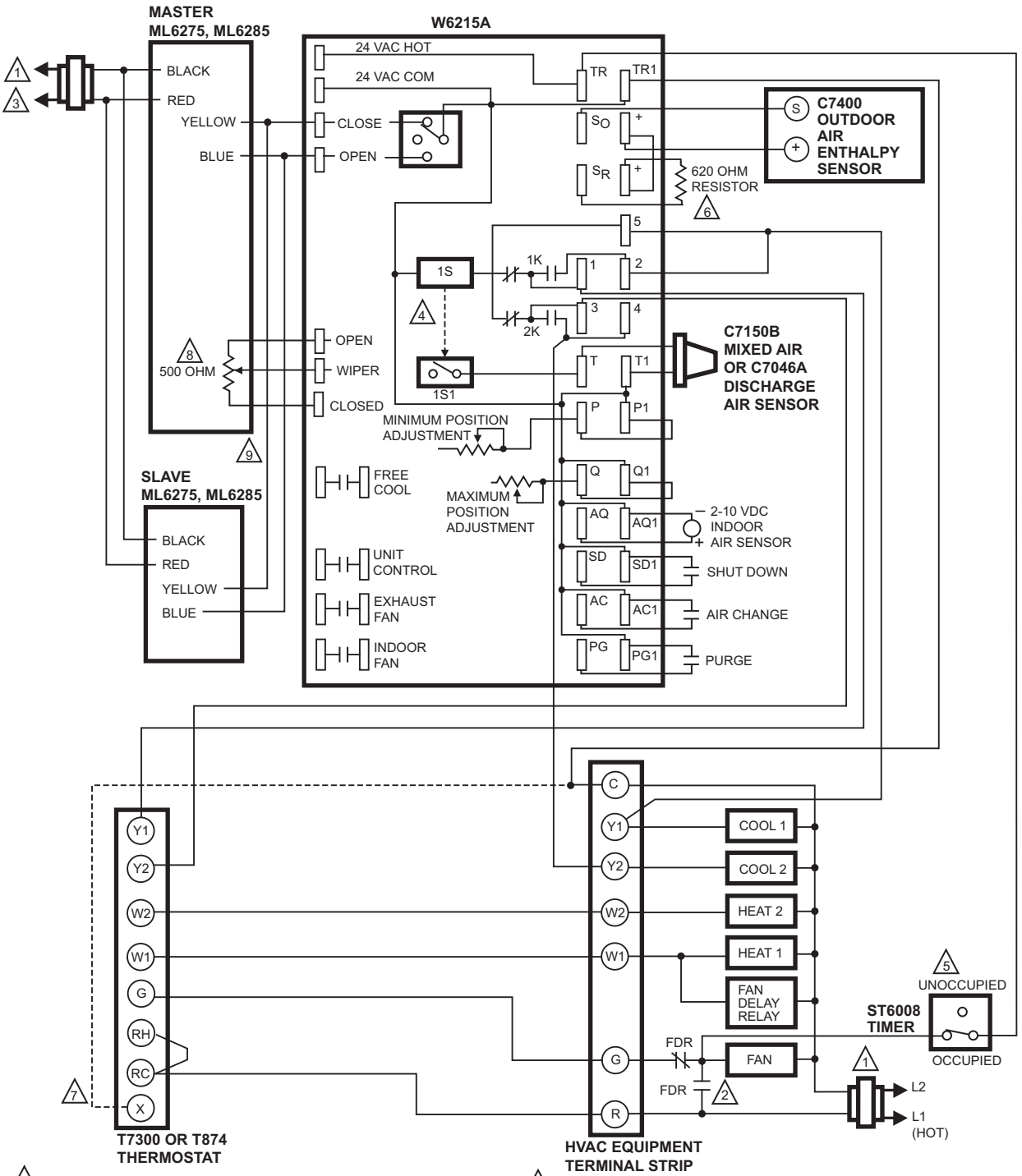
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 FOR T7300 ONLY.

8 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

M11800A

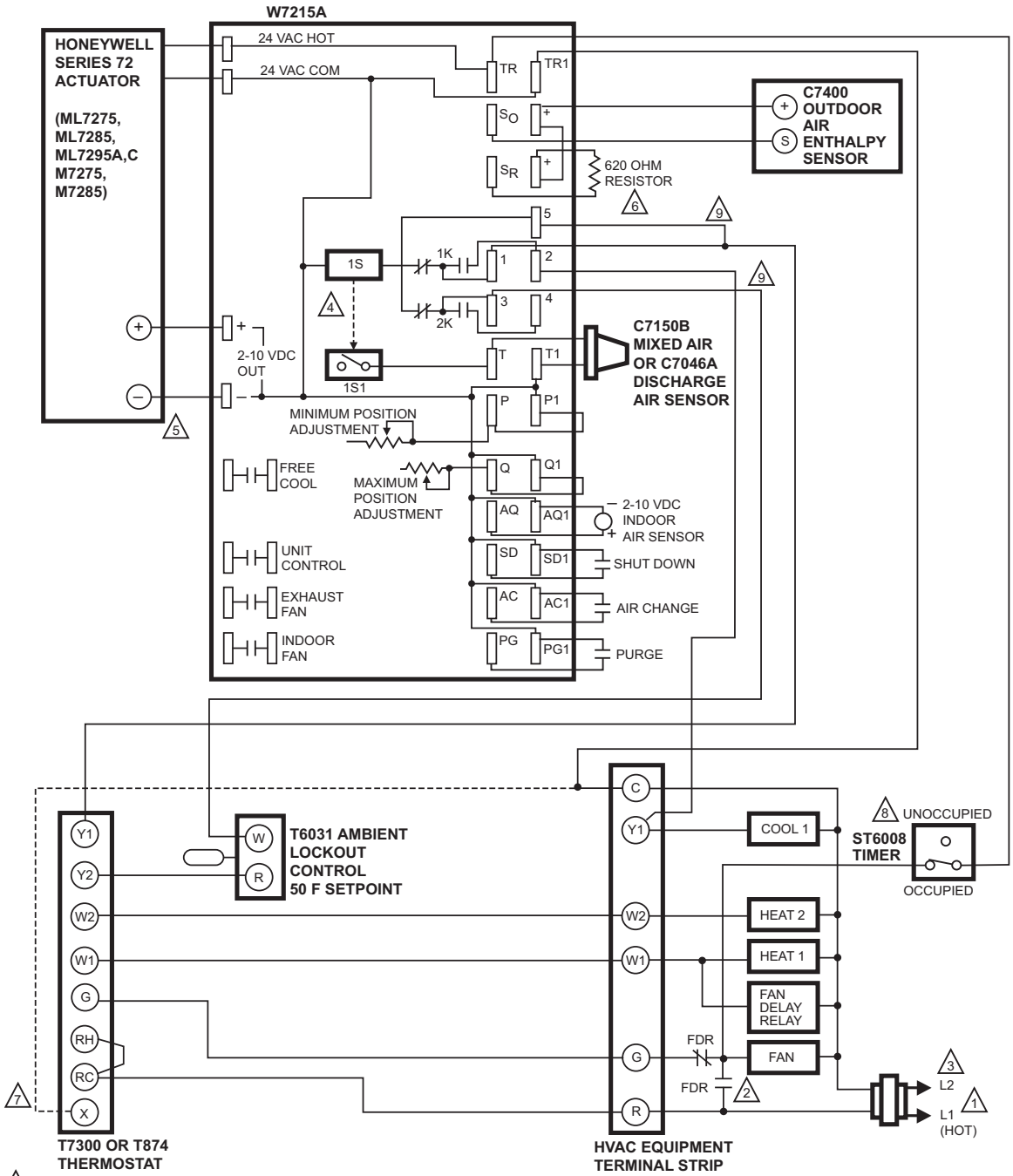
W6215A used in two-stage cooling system with a Honeywell Series 62 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE LOAD OF ALL ACTUATORS.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. CONNECT ONLY THE MASTER ACTUATOR TO THE W6215 FEEDBACK OUTPUT.
9. THE COMMON FOR THE W6215A IS DIFFERENT THAN THE COMMON (WIPER) FOR THE SERIES 62 ACTUATORS. BE SURE TO CONNECT EACH TO A DIFFERENT CIRCUIT.

M16060A

W6215 controlling parallel-wired Honeywell Series 62 Direct Coupled Actuators



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 FOR THE ML7295A,C, USE THE 4-20mA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.

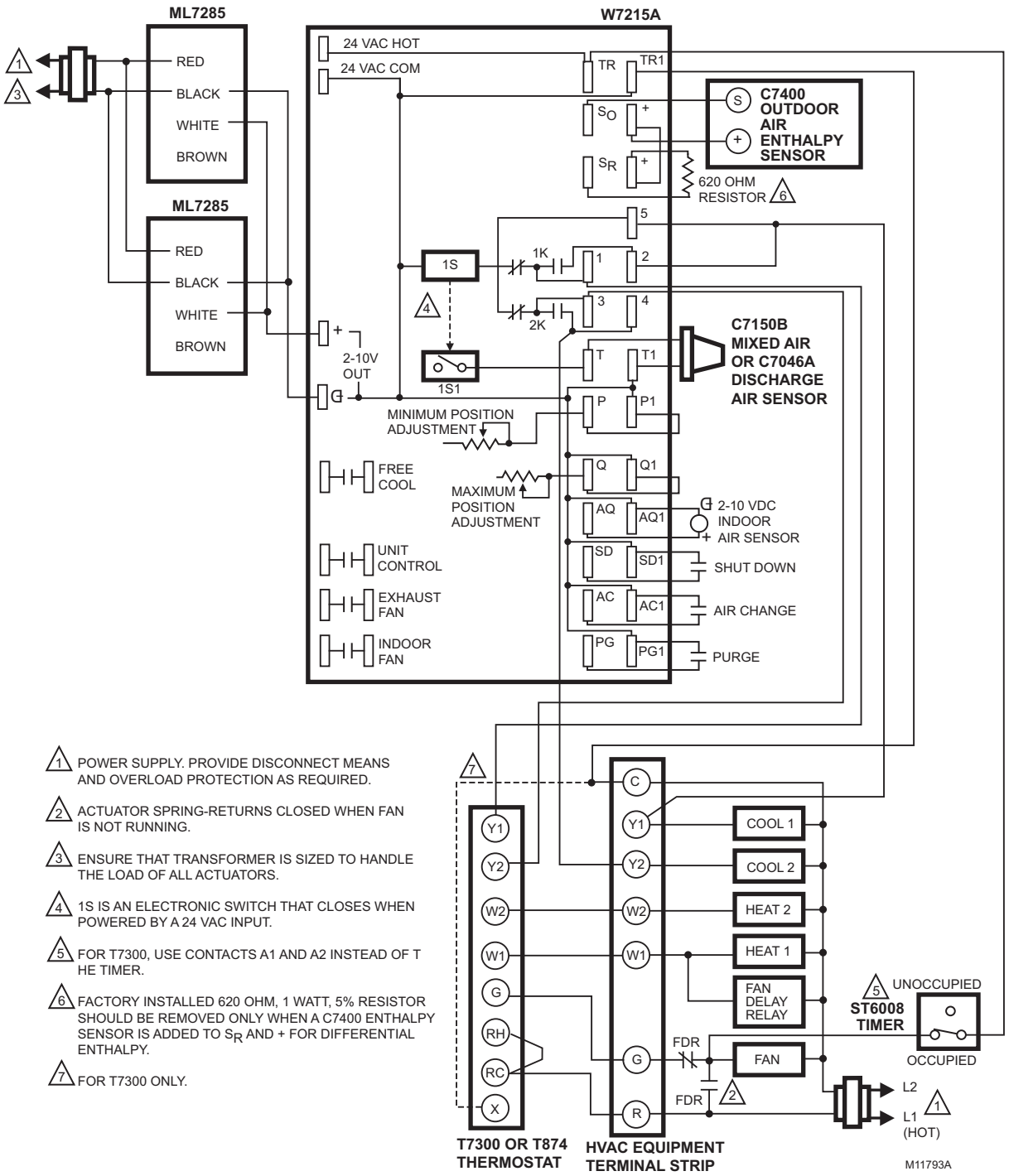
7 FOR T7300 ONLY.

8 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

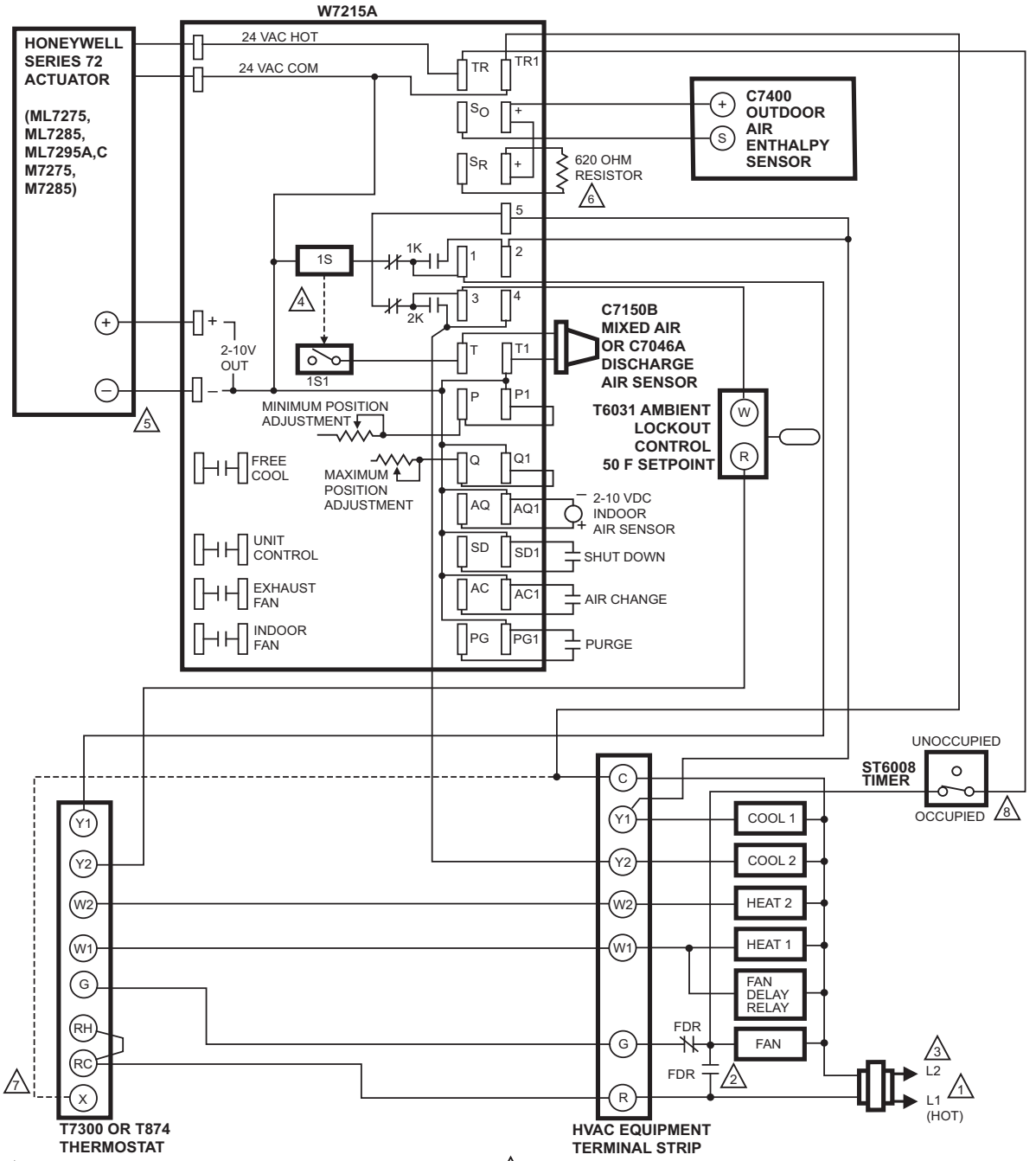
9 FOR TWO-STAGE COMMERCIAL THERMOSTATS ONLY.

M11804A

W7215A used in single-stage cooling system with single enthalpy changeover and Honeywell Series 72 Actuator



W7215A controlling parallel-wired Honeywell Series 72 Direct Coupled Actuators



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2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 FOR THE ML7295A,C, USE THE 4-20 mA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

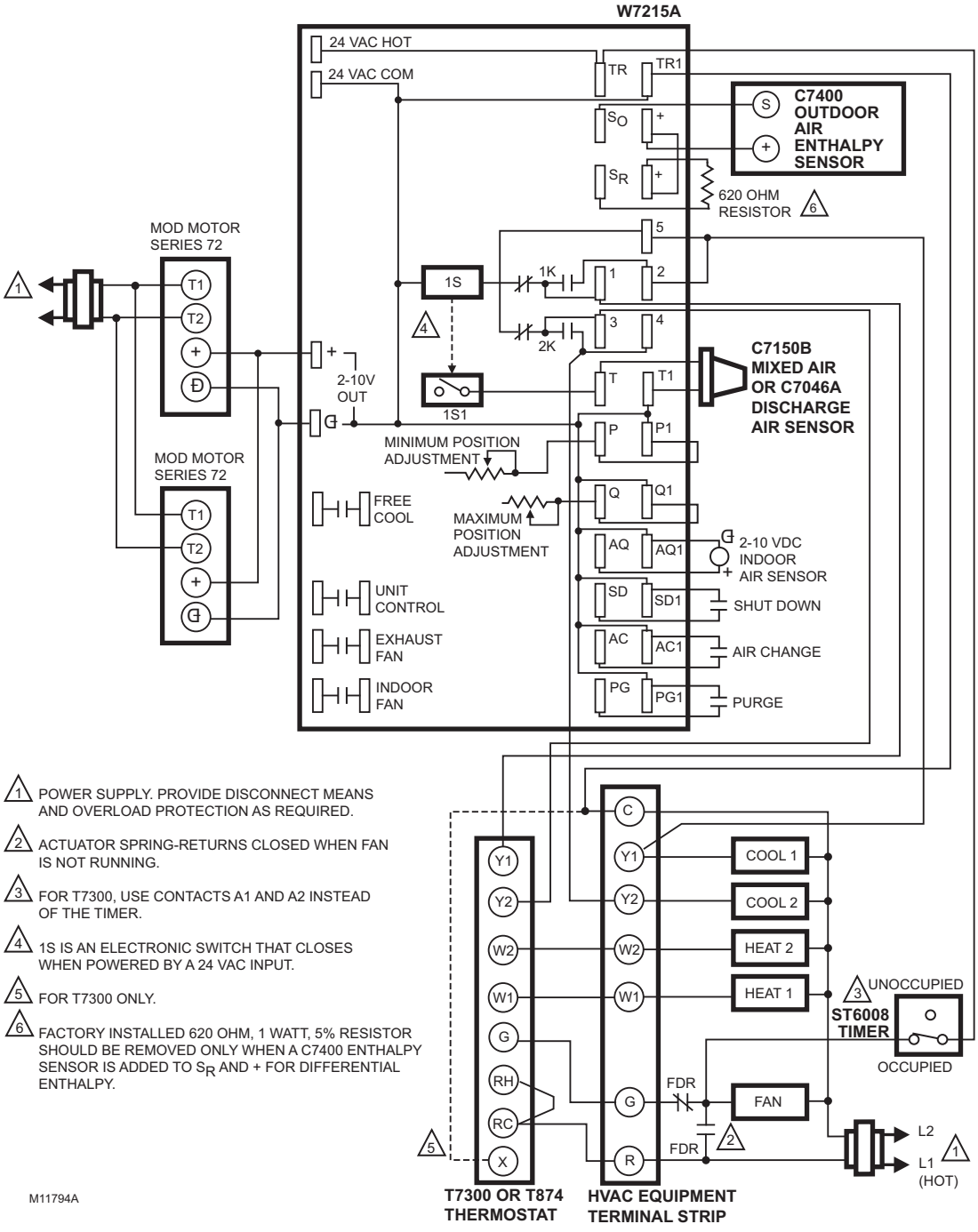
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 FOR T7300 ONLY.

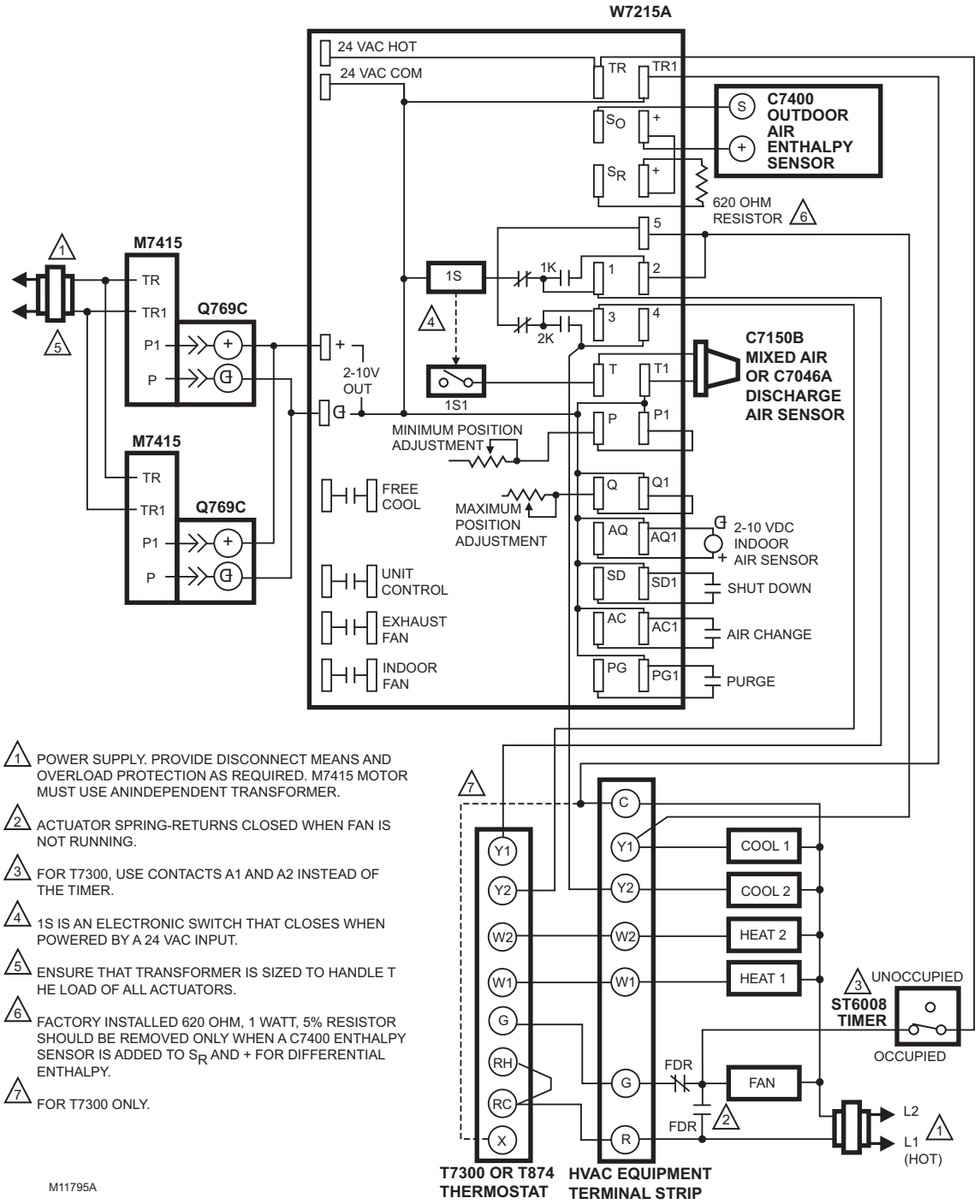
8 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

M11801A

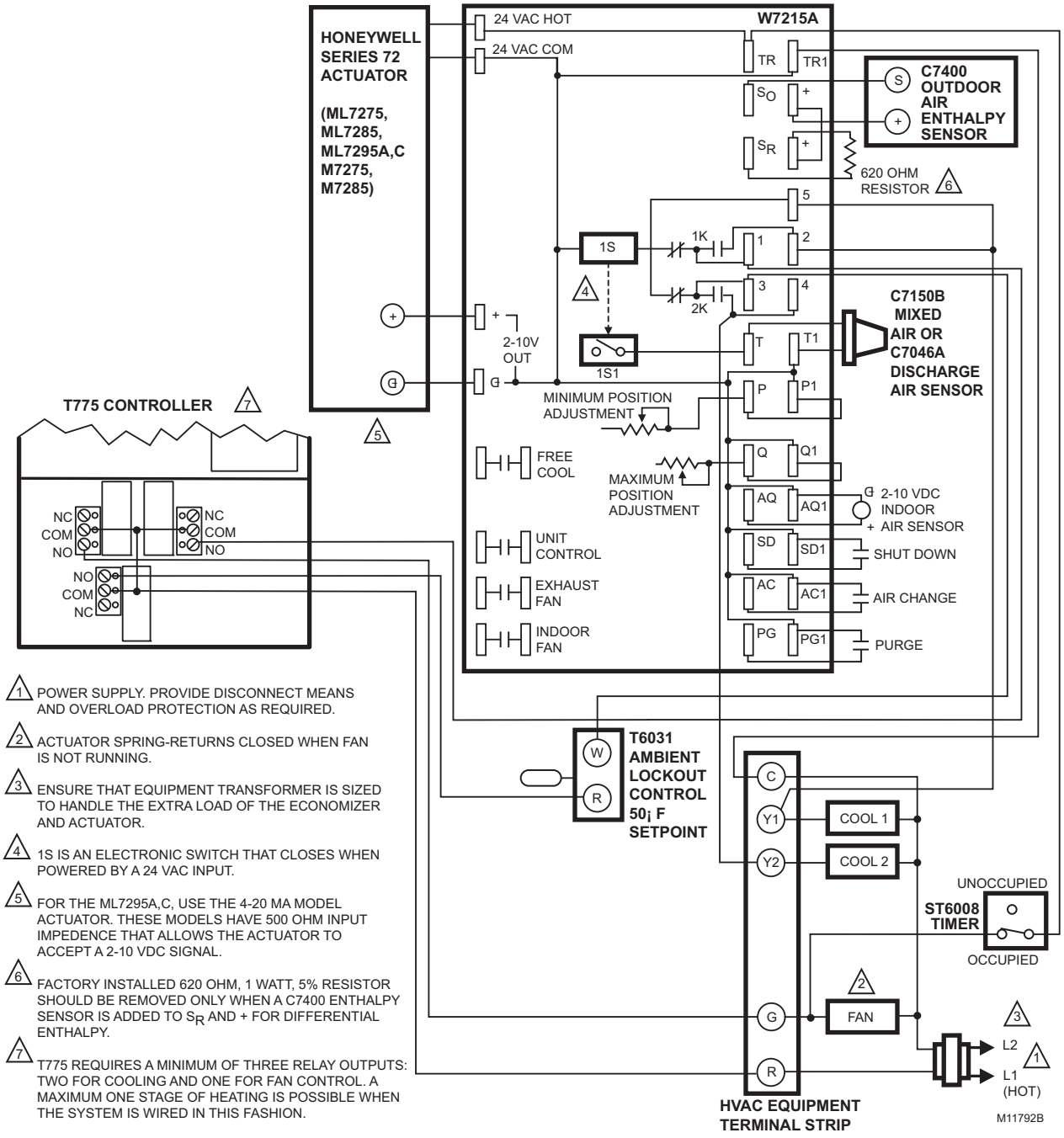
W7215A used in two-stage cooling system with Honeywell Series 72 Actuator



W7215A controlling parallel-wired Honeywell Series 72 Modutrol Motors



W7215A controlling parallel-wired M7415 Motors



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2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

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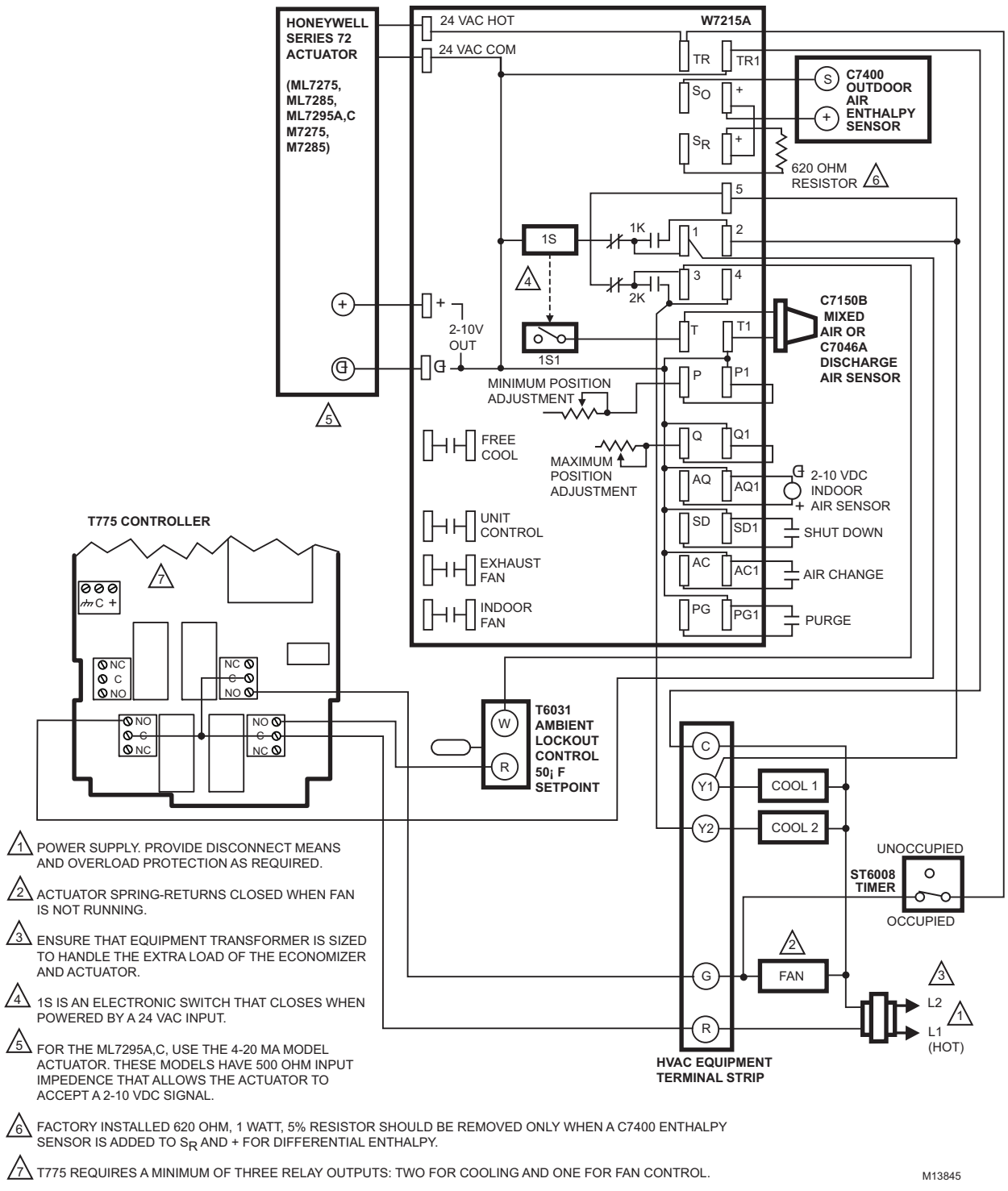
4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 FOR THE ML7295A,C, USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL. A MAXIMUM ONE STAGE OF HEATING IS POSSIBLE WHEN THE SYSTEM IS WIRED IN THIS FASHION.

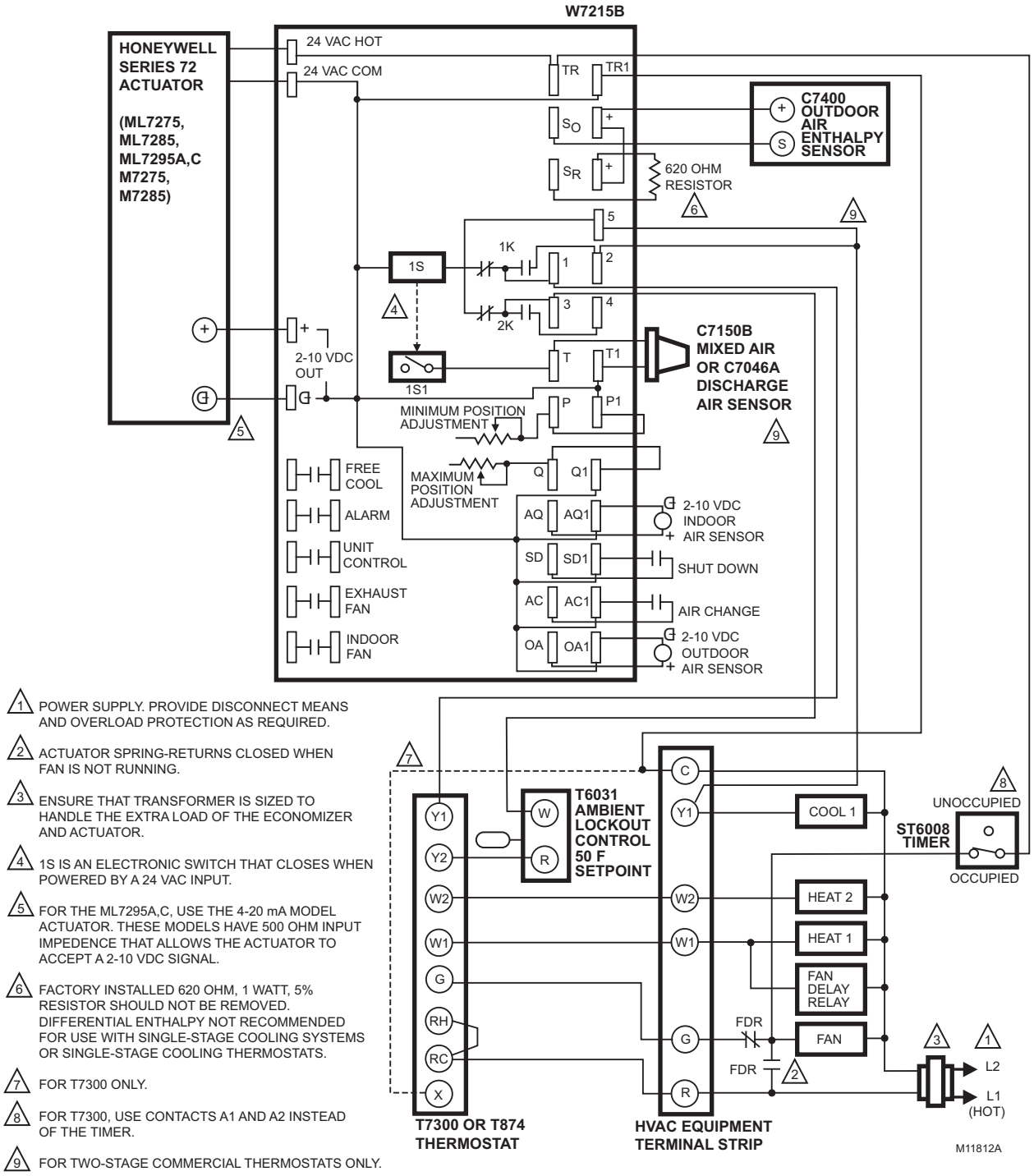
W7215A used with T775 Series 1000 Controller and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. FOR THE ML7295A,C, USE THE 4-20 MA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL.

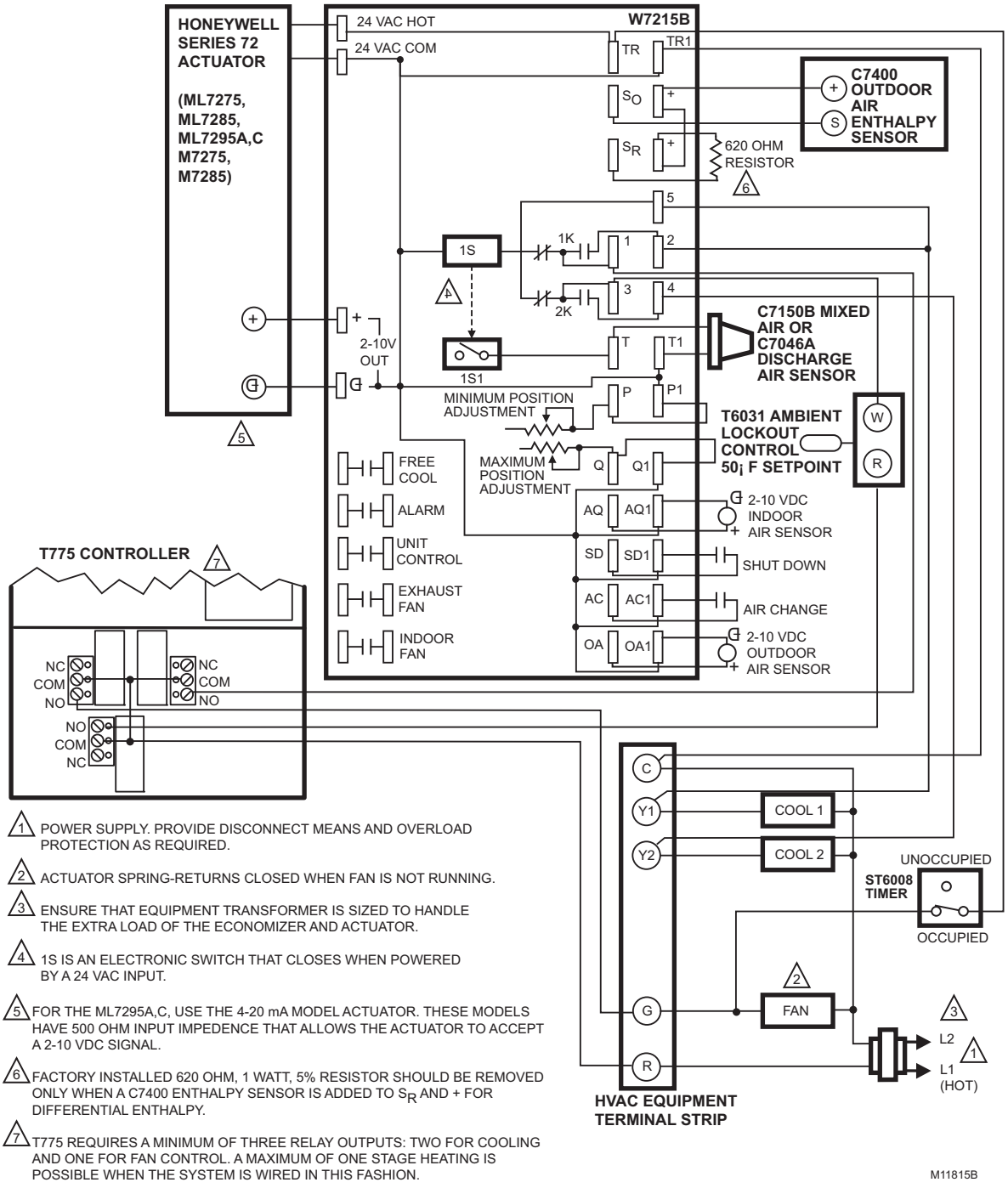
M13845

W7215A used with T775 Series 2000 Controller and Honeywell Series 72 Actuator



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. FOR THE ML7295A,C, USE THE 4-20 mA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
9. FOR TWO-STAGE COMMERCIAL THERMOSTATS ONLY.

W7215B used in single-stage cooling system with single enthalpy changeover and Honeywell Series 72 Actuator



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 ENSURE THAT EQUIPMENT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.

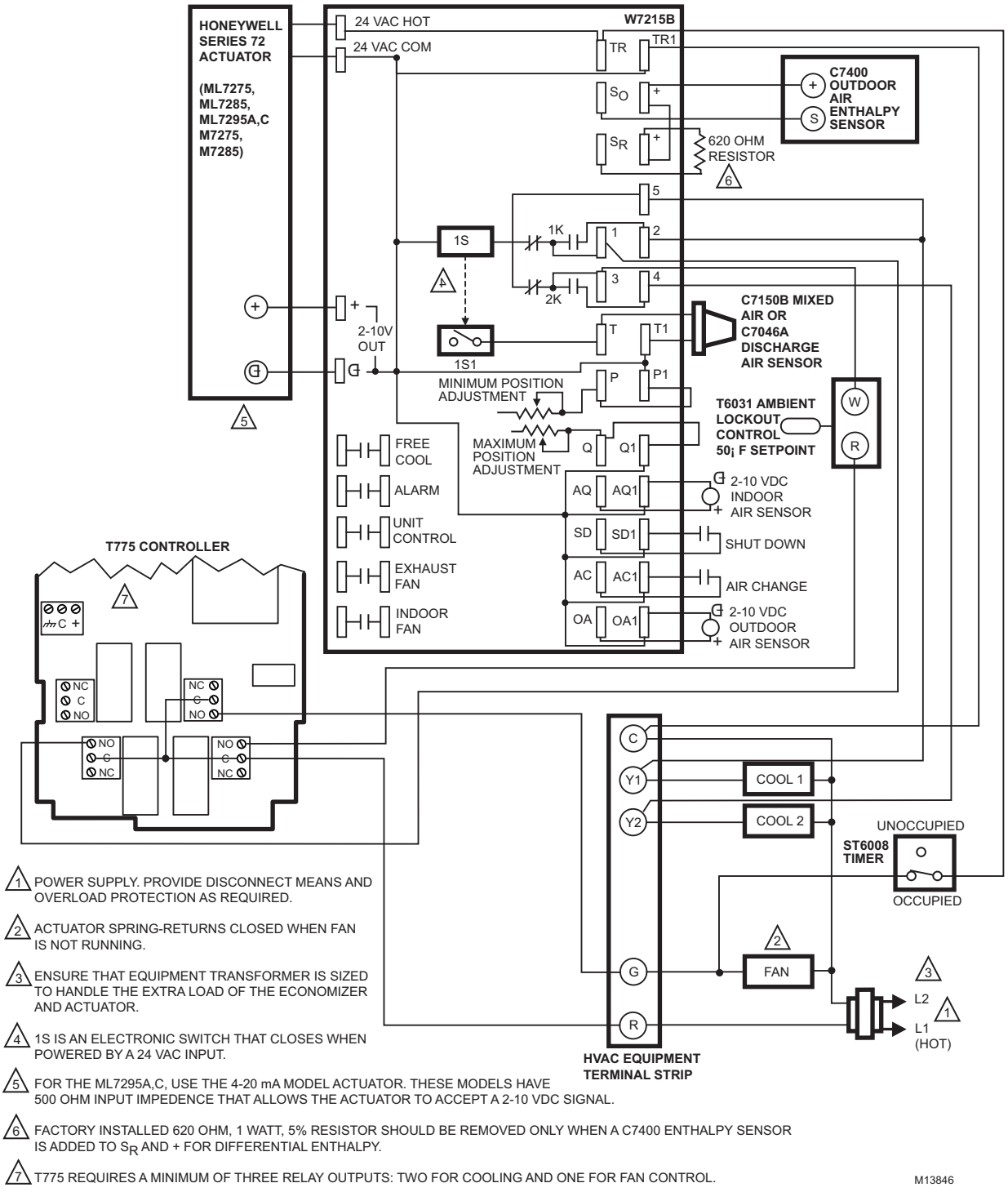
4 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

5 FOR THE ML7295A,C, USE THE 4-20 mA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.

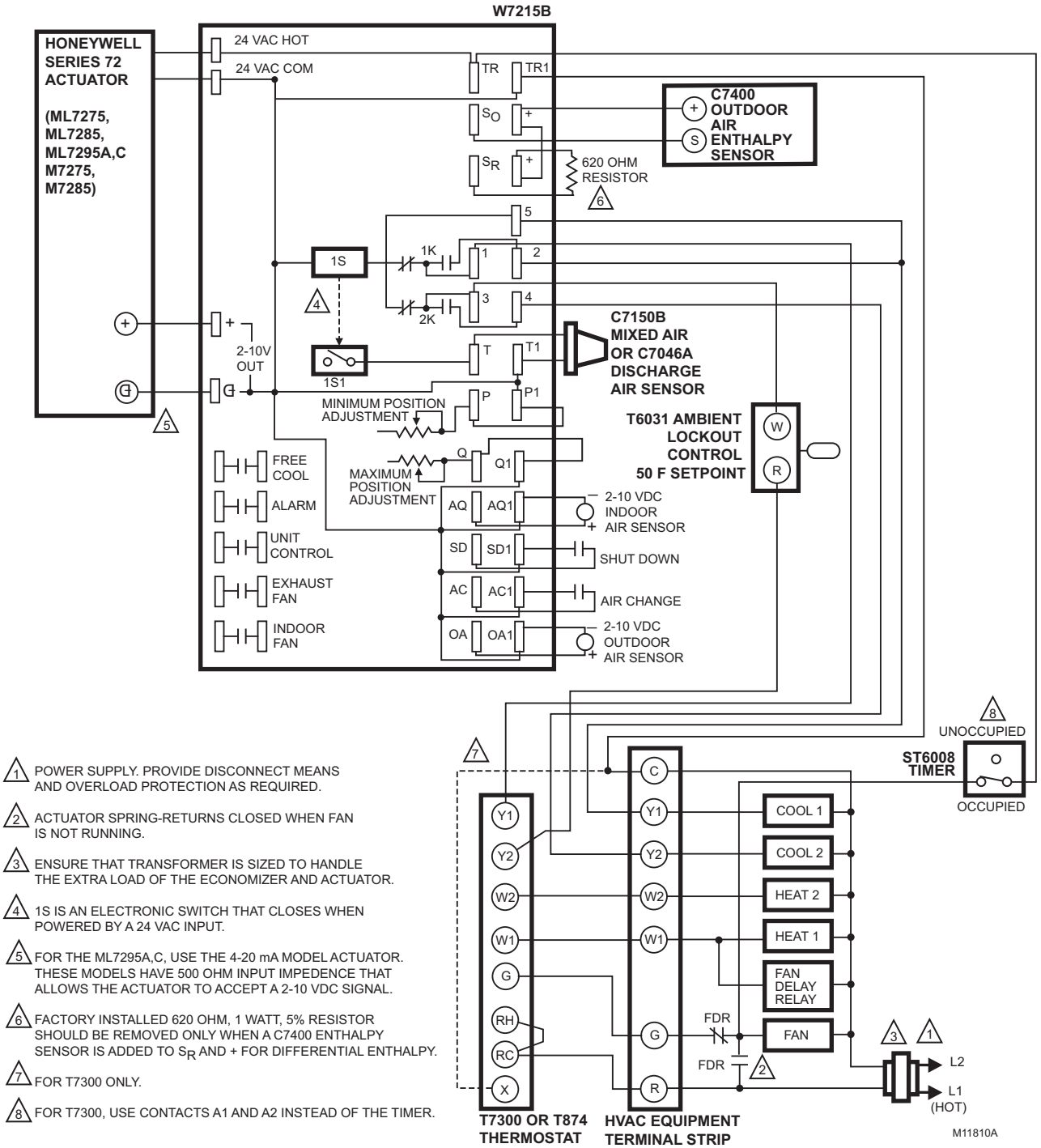
6 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.

7 T775 REQUIRES A MINIMUM OF THREE RELAY OUTPUTS: TWO FOR COOLING AND ONE FOR FAN CONTROL. A MAXIMUM OF ONE STAGE HEATING IS POSSIBLE WHEN THE SYSTEM IS WIRED IN THIS FASHION.

W7215B used with T775 Series 1000 Controller and Honeywell Series 72 Actuator

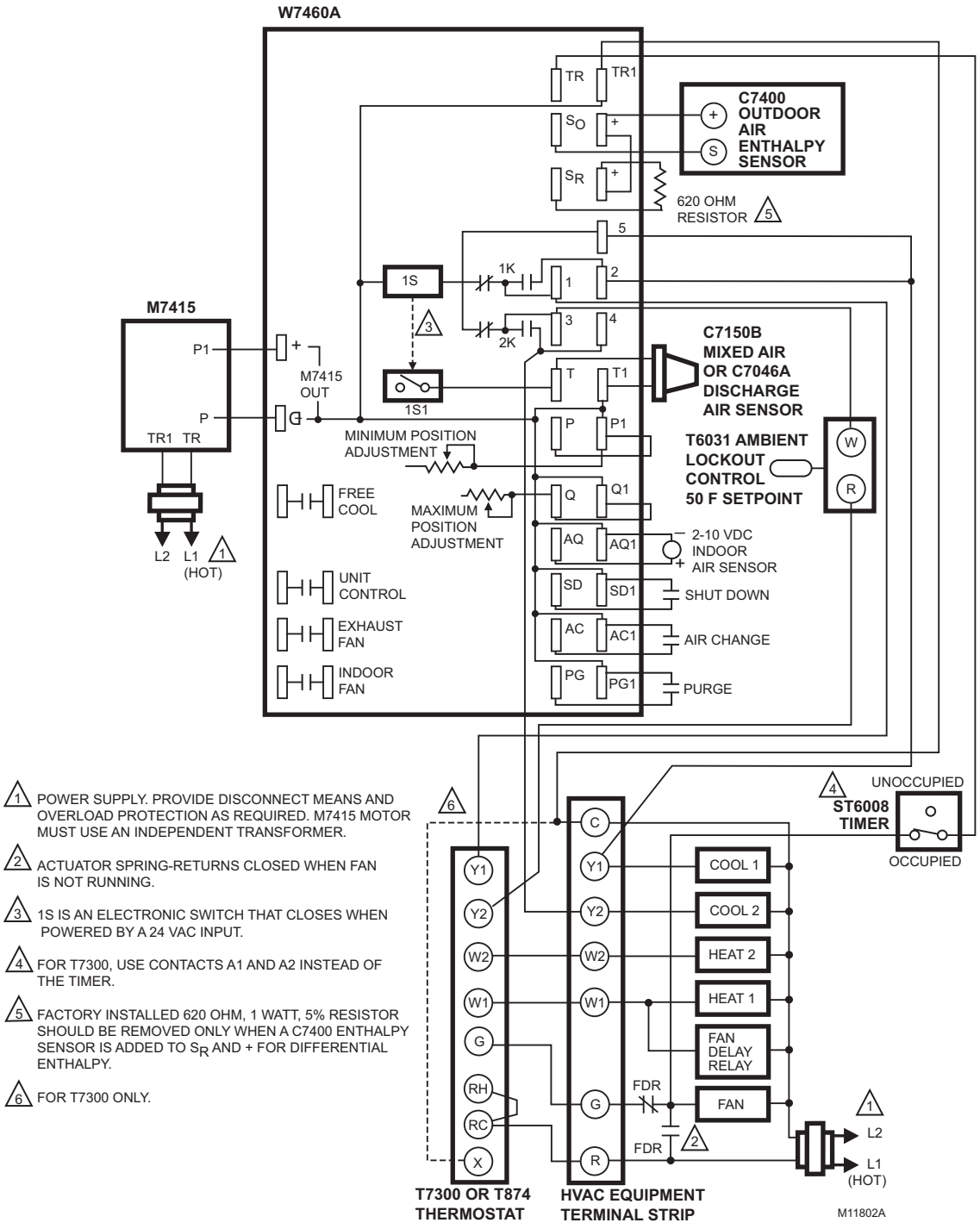


W7215B used with T775 Series 2000 Controller and Honeywell Series 72 Actuator



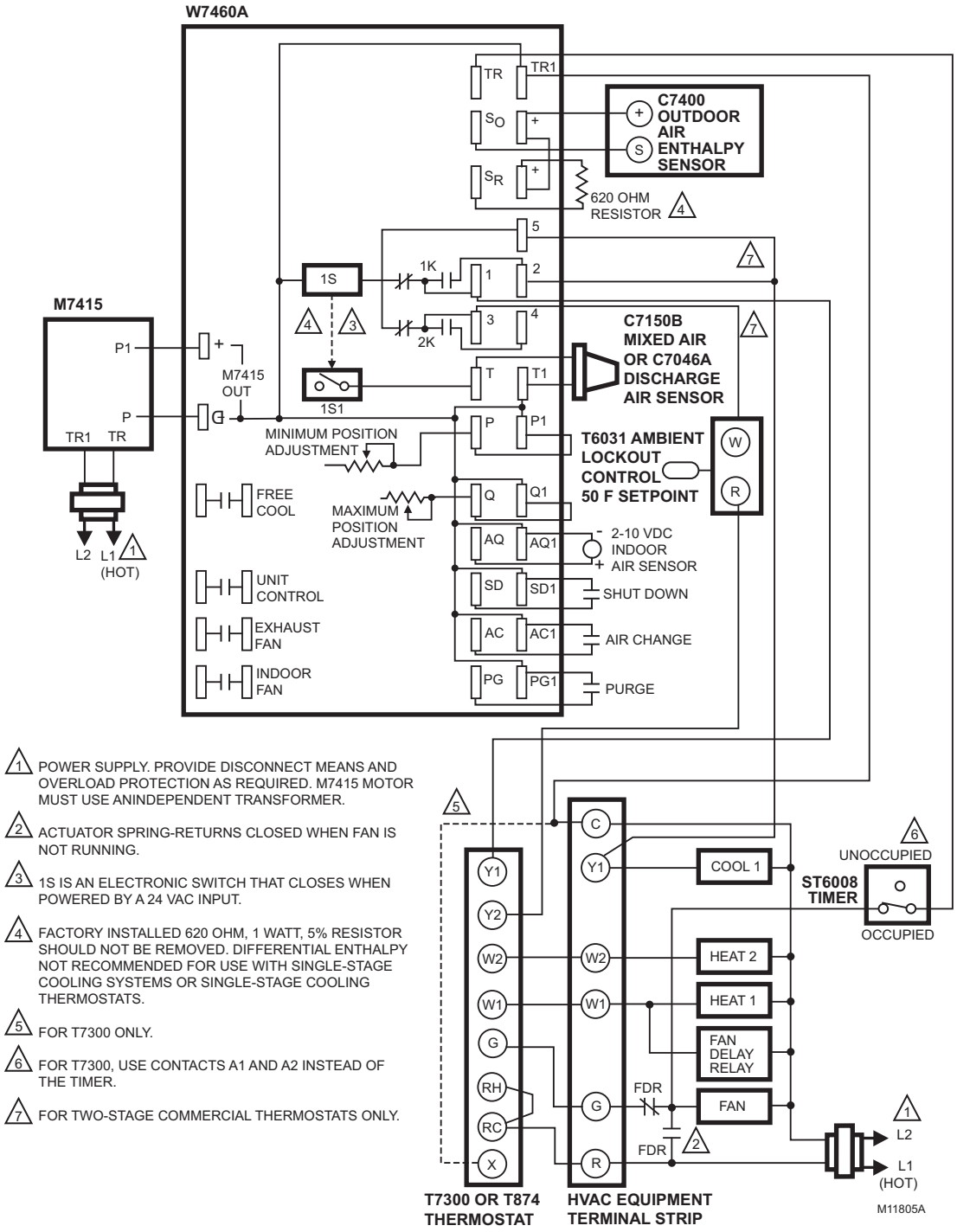
1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
4. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
5. FOR THE ML7295A,C, USE THE 4-20 mA MODEL ACTUATOR. THESE MODELS HAVE 500 OHM INPUT IMPEDENCE THAT ALLOWS THE ACTUATOR TO ACCEPT A 2-10 VDC SIGNAL.
6. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
7. FOR T7300 ONLY.
8. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

W7215B used in two-stage cooling system with Honeywell Series 72 Actuator



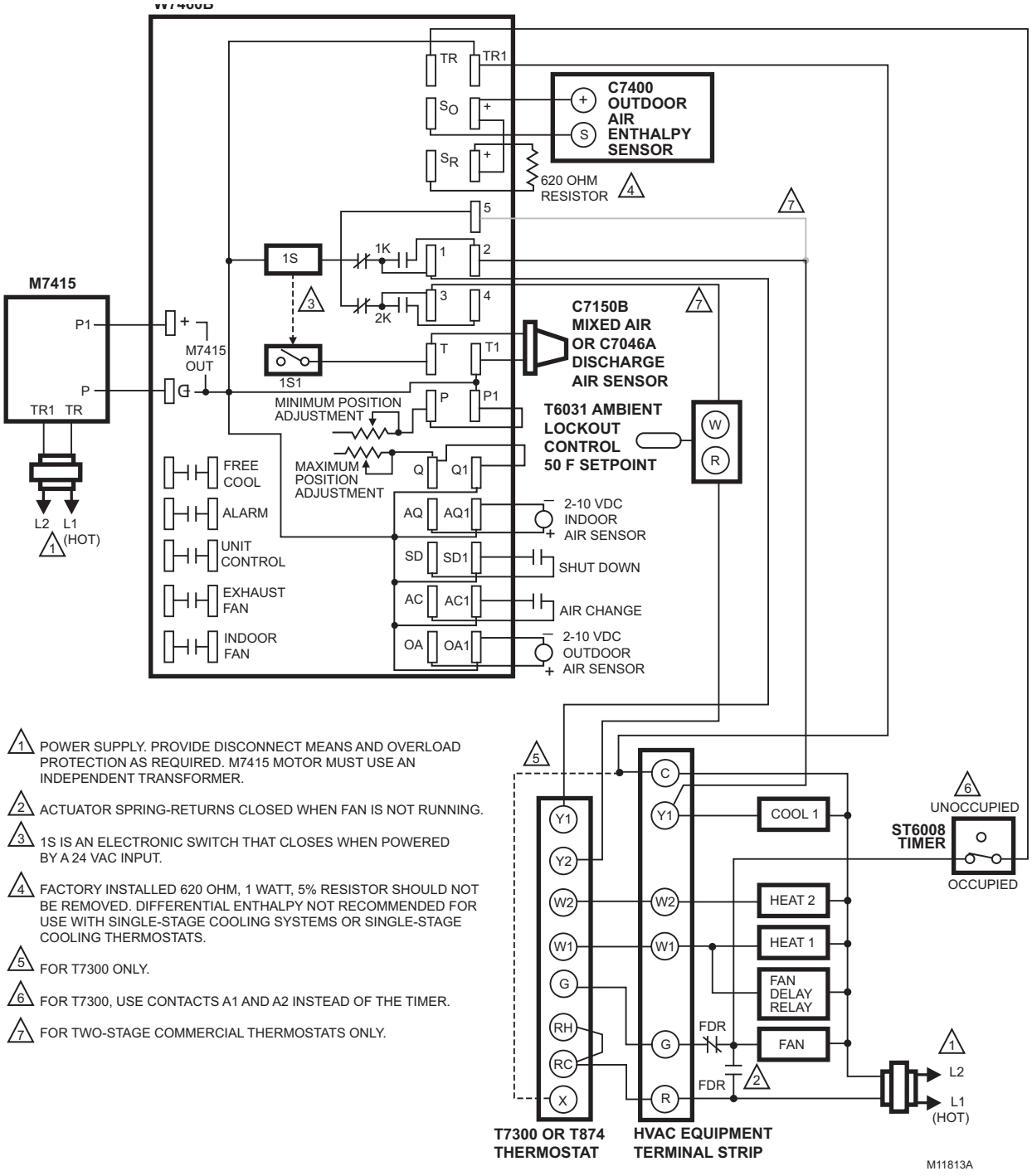
1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED. M7415 MOTOR MUST USE AN INDEPENDENT TRANSFORMER.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
4. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
5. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
6. FOR T7300 ONLY.

W7460A used in two-stage cooling system with M7415 Motors



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED. M7415 MOTOR MUST USE ANINDEPENDENT TRANSFORMER.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
4. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
5. FOR T7300 ONLY.
6. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
7. FOR TWO-STAGE COMMERCIAL THERMOSTATS ONLY.

W7460A used in single-stage cooling system with single enthalpy changeover and M7415 Motors



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED. M7415 MOTOR MUST USE AN INDEPENDENT TRANSFORMER.

2 ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.

3 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.

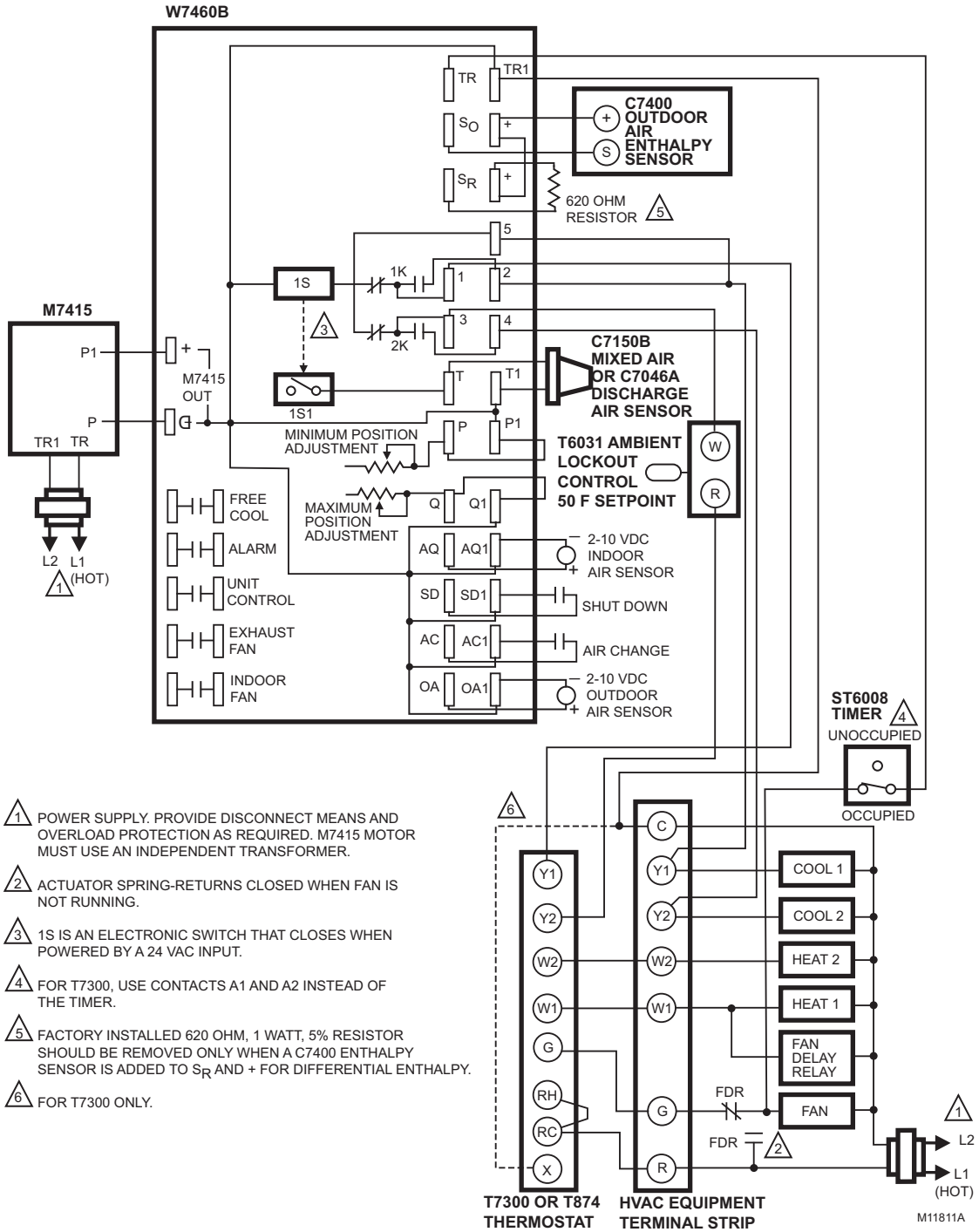
4 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.

5 FOR T7300 ONLY.

6 FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.

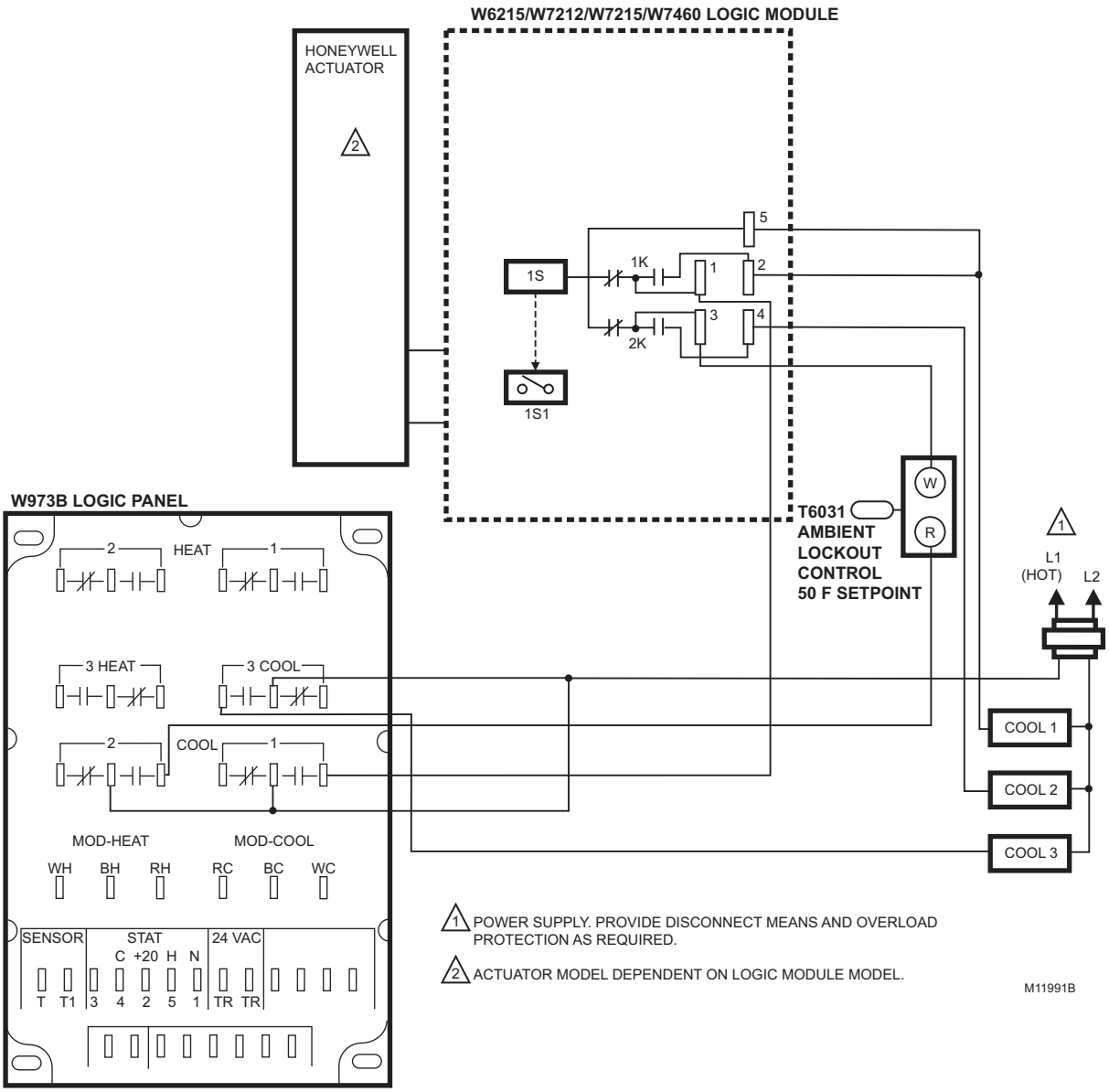
7 FOR TWO-STAGE COMMERCIAL THERMOSTATS ONLY.

W7460B used in single-stage cooling system with single enthalpy changeover and M7415 Motors



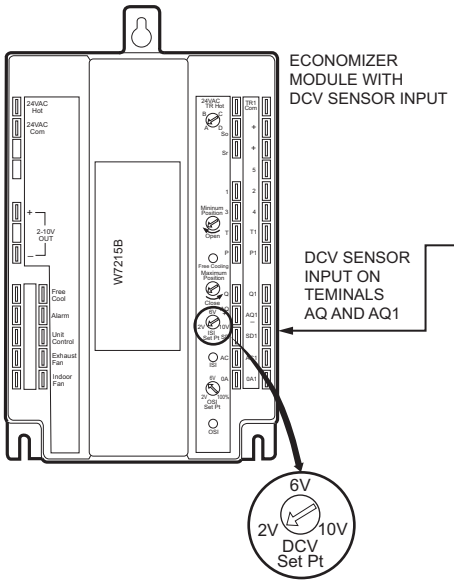
1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED. M7415 MOTOR MUST USE AN INDEPENDENT TRANSFORMER.
2. ACTUATOR SPRING-RETURNS CLOSED WHEN FAN IS NOT RUNNING.
3. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
4. FOR T7300, USE CONTACTS A1 AND A2 INSTEAD OF THE TIMER.
5. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO S_R AND + FOR DIFFERENTIAL ENTHALPY.
6. FOR T7300 ONLY.

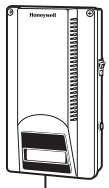
W7460B used in two-stage cooling system with M7415 Motors



W6215, W7215, or W7460 used with W973B Logic Panel

Indoor Air Content Sensor Settings





C7242 INDOOR
AIR CONTENT
CO2 SENSOR

SENSOR OUTPUT IN VOLTS DC	ROOM CONCENTRATION CARBON DIOXIDE IN PARTS PER MILLION
0	500
1	650
2	800
3	950
4	1100
5	1250
6	1400
7	1550
8	1700
9	1850
10	2000

M23925

The DCV input can be any sensor with a 2 to 10 Vdc output such as the Honeywell C7242, C7232 or C7632 carbon dioxide (CO_2)sensor. The sensor is supplied with preset configurations that can be used if they meet the application requirements. The output of the C7242 and C7232 sensors is re-configurable using a desktop computer and a serial connection directly to the sensor or by switches inside the cover. The C7632 is not a configurable sensor and has a fixed 0-2000 Vdc output and no relay outputs. The output chart illustrated on the right side of this page is the Analog 1 configuration of startpoint and throttling range for a linear output. The effect on the mixed air control module can be further adjusted with the DCV setpoint illustrated on the left. The typical setting for this adjustment is 2 Vdc. With this setting, the effect of the room DCV sensor begins when the sensor output is 2 Vdc. The installer sets the output range and the DCV setpoint on the economizer to adhere to local codes.

Carbon Dioxide Sensor Setup

CO2 Sensors	Display	No Display	A1 Output	A2 Output
Wall Mount With Relay	C7242A1030	C7242A1048	0 Vdc = 500 ppm (2 Vdc = 800 ppm) and 10 Vdc = 2,00 ppm	Relay Output: 0 to 800 ppm = Open, More than 800 ppm = Closed, Reopens at less than 700 ppm
Wall Mount	C7242A1014	C7242A1022		Analog Sensor Mode: 0 Vdc = 500 ppm (2 Vdc = 800 ppm) and 10 Vdc = 2,000 ppm Time interval = 2 seconds
Duct Mount	C7242B1012	C7242B1020		
Outside Air	Not Available	C7232E1007		

For applications where factory configurations do not meet the application requirements the sensor may be re-configured by the installer to meet most configuration needs. To reconfigure the sensor connect the C7242 to a PC using the RS232 Cable and PC Configuration Software, number 32002183-001. The configuration software allows extensive configuration control via five Proportional plus Integral controls and a Delay Timer control.

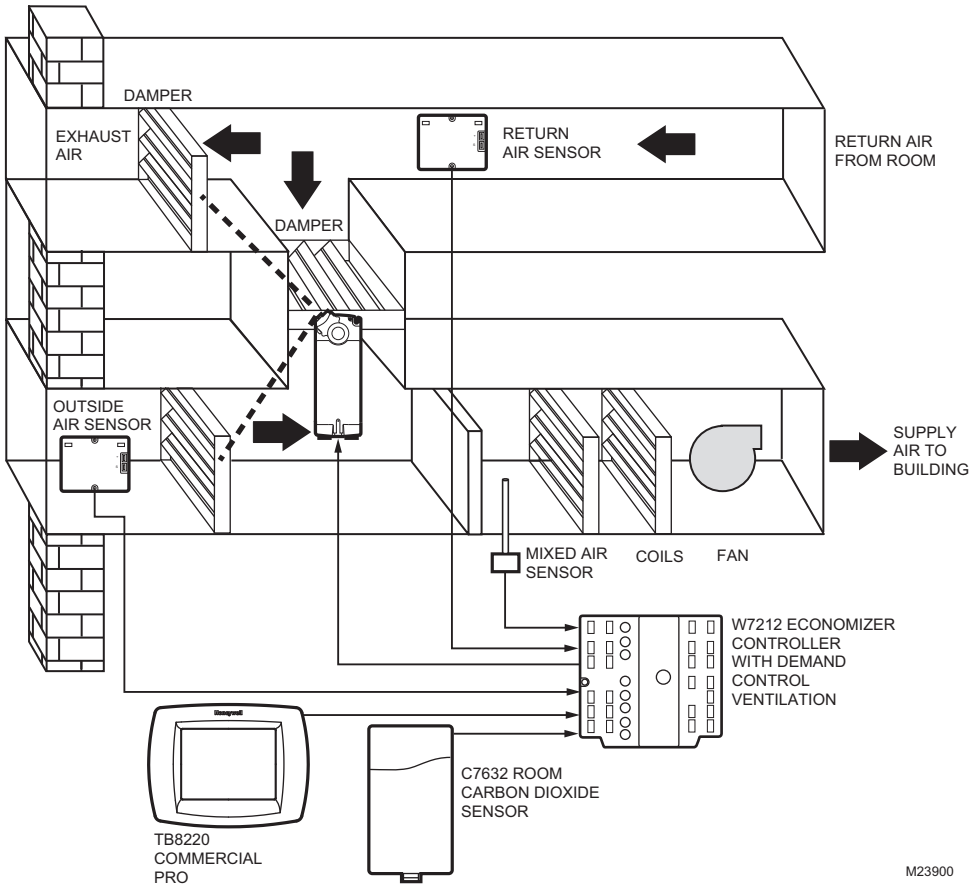
The Delay Timer (DT) function permits a digital input to be used to make a step change in the analog output from the sensor. A typical application is a manual push-button that after it is pushed the sensor output is boosted to 100% for five minutes to increase the volume of outside air for ventilation.

For complete information about configuration of the sensor, refer to the programming manual in the RS232 Cable and PC Configuration Software package.

Most installers prefer to use a C7632 CO_2 sensor that does not need to be programed or adjusted when installed.

Section 8 - W7212, W7213 and W7214 Economizer Modules

W7212 Economizer System Components



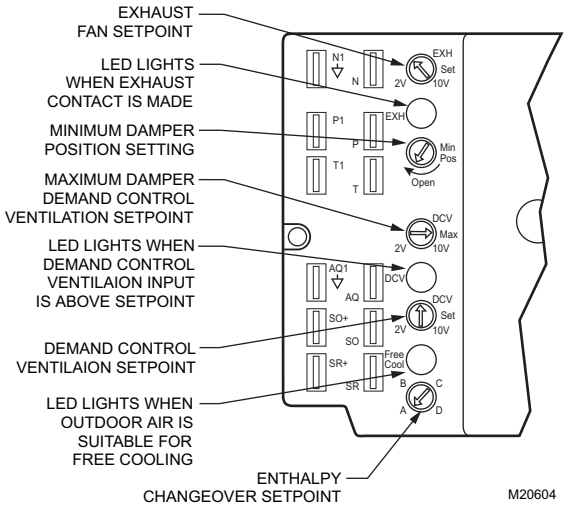
W7212, W7213, and W7214 Components

The W7212 DCV economizer logic module is the simplest and most popular economizer model. It combines all of the benefits of the W7459 and W7210 with the some features of the W7215. It does not include shutdown, air change and purge but does have a “N” terminal for night setback. On W7213 and W7214 models N terminal is either B or O terminal for use with heat pumps.

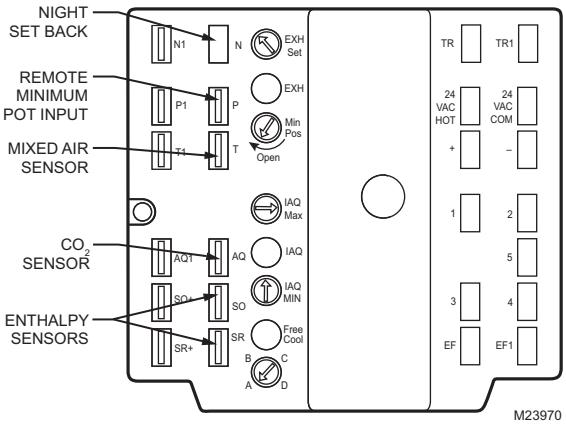
There are three models:

- W7212A- Used with series 70 actuators including DCA’s and Modutrol Motors
- W7213A - Used with heat pumps or conventional rooftop units. B terminal energized in heating and unenergized in cooling
- W7214A - Used with heat pumps or conventional rooftop units. O terminal unenergized in heating and energized in cooling.

All models can be panel mounted or directly mounted to M7215 motor.



Potentiometer and LED locations (W7212 shown)



Power at the N terminal determines the Occupied/Unoccupied setting:

For the W7212:

- 24 Vac (Occupied)
- No power (Unoccupied)
- N terminal powered – Space Occupied:
  - — If No Call for cooling or bad outdoor enthalpy - dampers drive to minimum position
  - — If Call for cooling - dampers open to satisfy the mixed or discharge air sensor if outdoor air is good enthalpy
- N terminal unpowered – Space Unoccupied:
  - — If No call for cooling - damper drives closed if economizer is powered
  - — If Call for cooling - dampers open to satisfy the mixed or discharge air sensor if outdoor air is good enthalpy

For the W7213 and W7214:
- 24 Vac (Unoccupied)
- No power (Occupied)

All other inputs are same as other logic modules, for space consideration the enthalpy sensor terminals were moved to left side of control.

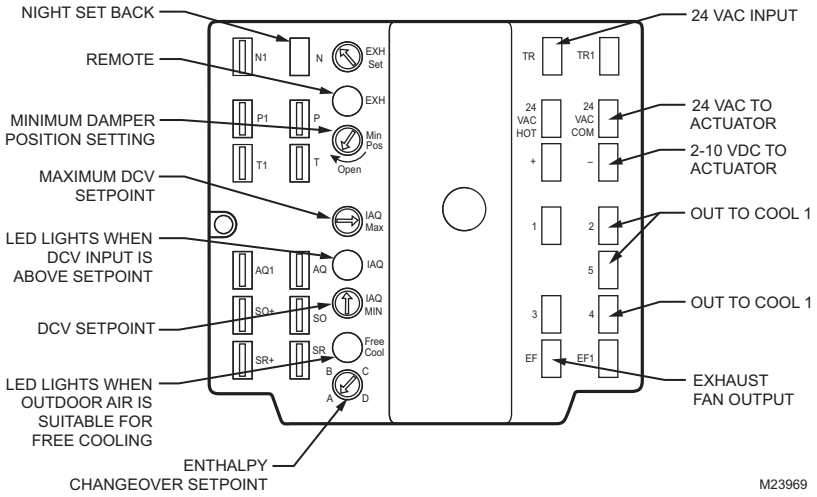
Same input for TR-TR1 for 24 Vac power to logic module and output to mechanical cooling.

Output for 2-10 Vdc and 24 Vac power to actuator is on the right side of the unit and exhaust fan output has been added.

The exhaust setpoint determines when the exhaust fan runs based on damper position. When the exhaust fan call is made, the module provides a 60 ±30 second delay before exhaust fan activation. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

EF and EF1 are 24V dry contacts only. An external line voltage contactor is required to operate the exhaust fan.

When the exhaust fan is deactivated the EF and EF1 relay opens immediately.



The exhaust setpoint determines when the exhaust fan runs based on damper position. Full CCW is fully closed damper position and Full CW is fully open damper position.

When the EF and EF1 contacts are made after the 60 ±30 sec. delay, the EXH LED will illuminate.

Damper minimum position and maximum position are the positions of the damper for ventilation for building contaminants and people occupancy. See section 1 for explanation of DCV and determination of damper settings.

DCV Maximum Position Adjustment

1. Disconnect mixed air sensor from terminals T and T1 and short terminals T and T1.
2. Connect a jumper between terminals AQ and SO+.
3. Connect 24 Vac across terminals TR and TR1.
4. Adjust the potentiometer on the face of the device with a screwdriver for desired maximum position.

5. If all minimum and maximum position adjustments are complete, remove the T-T1 jumper and reconnect the mixed air sensor.

When the mixed air sensor takes control based on an increased requirement for cooling, it overrides the DCV maximum position potentiometer and can drive the damper full-open.

If the mixed air temperature drops to 45°F, the mixed air sensor overrides the DCV and fully closes the damper to protect from freezing the hot or chilled water coils. Control returns to normal once the mixed air temperature rises to 48°F.

DCV setpoint is the same as the W7215. The setpoint is based on the output of the CO_2 sensor (e.g., 0-10 Vdc output for CO_2 ppm of 500-1500 ppm where 0 Vdc = 500 ppm and 10 Vdc = 1500 ppm. If setpoint is 1000 ppm or 6 Vdc, then the OA damper will begin to module open when output from CO_2 sensor is 6 Vdc). DCV LED light will illuminate when CO_2 level is above setpoint.

Free cool LED illuminates when outdoor air is suitable for free cooling whether Y1 from the commercial thermostat is calling for cooling or not.

The W7212 uses the electronic A, B, C, D and high enthalpy curves on the psychrometric chart.

Minimum Position Adjustment

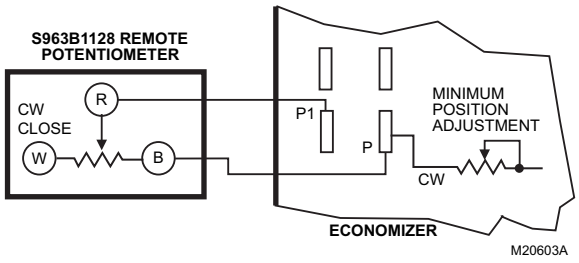
The following provides basic guidelines for minimum position selection and adjustment:

IMPORTANT

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air for building effluents, as required by local codes, to enter the building. This procedure requires use of a quality thermometer capable of reading to 0.5°F (0.25°C).

NOTE: Make minimum position adjustments with at least a 10°F (-12°C) temperature difference between outdoor and return air.

1. Calculate the appropriate mixed air temperature, see the Equation below.
2. Disconnect mixed air sensor from terminals T and T1.
3. Place a jumper across terminals T and T1.
4. Ensure that either the factory-installed jumper is in place across terminals P and P1 or, if remote damper position is required, that it is wired according the image below, turned fully clockwise.



S963B1128 Remote Potentiometer used with logic module for remote damper control

5. Connect 24 Vac across terminals TR and TR1.
6. Carefully adjust the potentiometer on the face of the device with a small screwdriver until the mixed air temperature reaches the calculated value.

   NOTE: Ensure that the sensed air is well mixed.

7. If all minimum and maximum position adjustments are complete, remove the T-T1 jumper and reconnect the mixed air sensor.

Formula to aid minimum position adjustment

$(T_O \times OA) + (T_R \times RA) = T_M$

Where:
T_O = Outdoor air temperature
OA = Percent of outdoor air
T_R = Return air temperature
RA = Percent of return air
T_M = Resulting mixed air temperature

NOTE: The following sample calculation uses only Fahrenheit temperature.

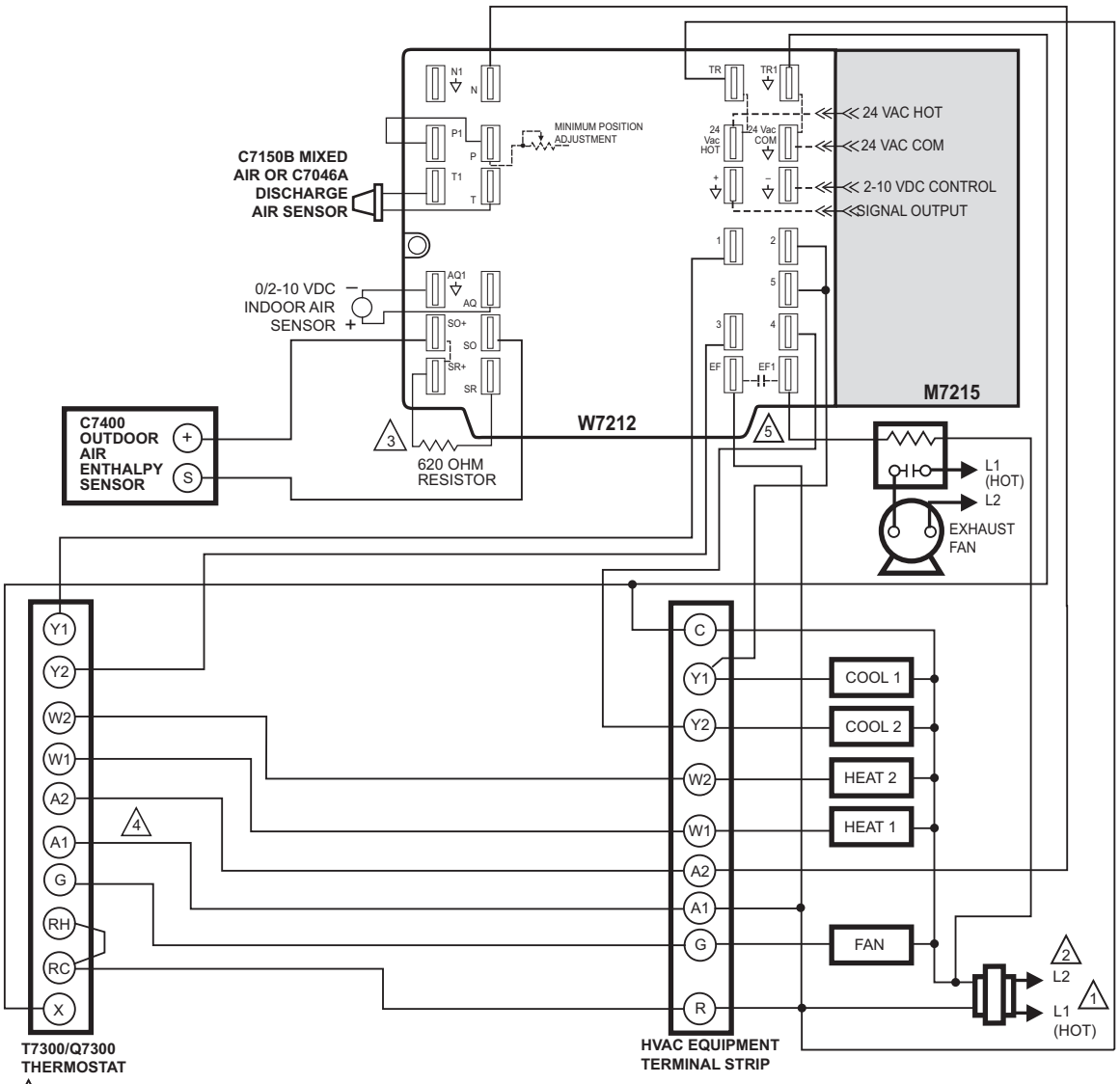
EXAMPLE: Assume local codes require 10% outdoor air during occupied conditions, outdoor air is 60°F and return air is 75°F. Under these conditions, what is the temperature of the mixed air?

(0.1 × 60°F) + (0.9 × 75°F) =

6.0°F + 67.5°F = 73.5°F

Mixed air will be 73.5°F when OA is 60°F and RA is 75°F with 10% outdoor air.

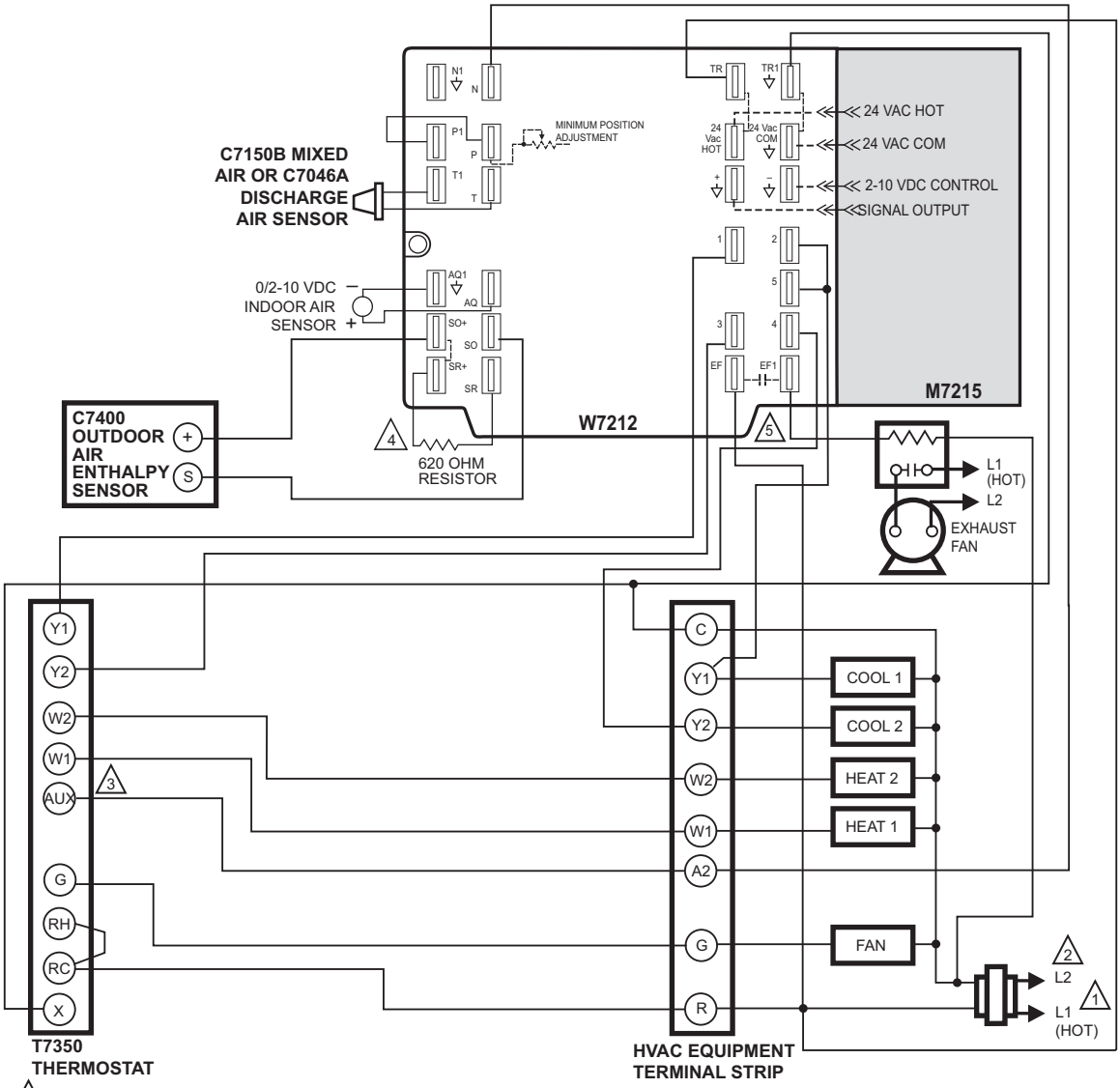
W7212, W7213, and W7214 Wiring Diagram



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR. USE THE SAME TRANSFORMER FOR T7300 AND ECONOMIZER.
3. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
4. T7300 TERMINALS A1 AND A2 ARE CONNECTED WHEN COMMERCIAL THERMOSTAT IS IN THE OCCUPIED MODE.
5. EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

M20716E

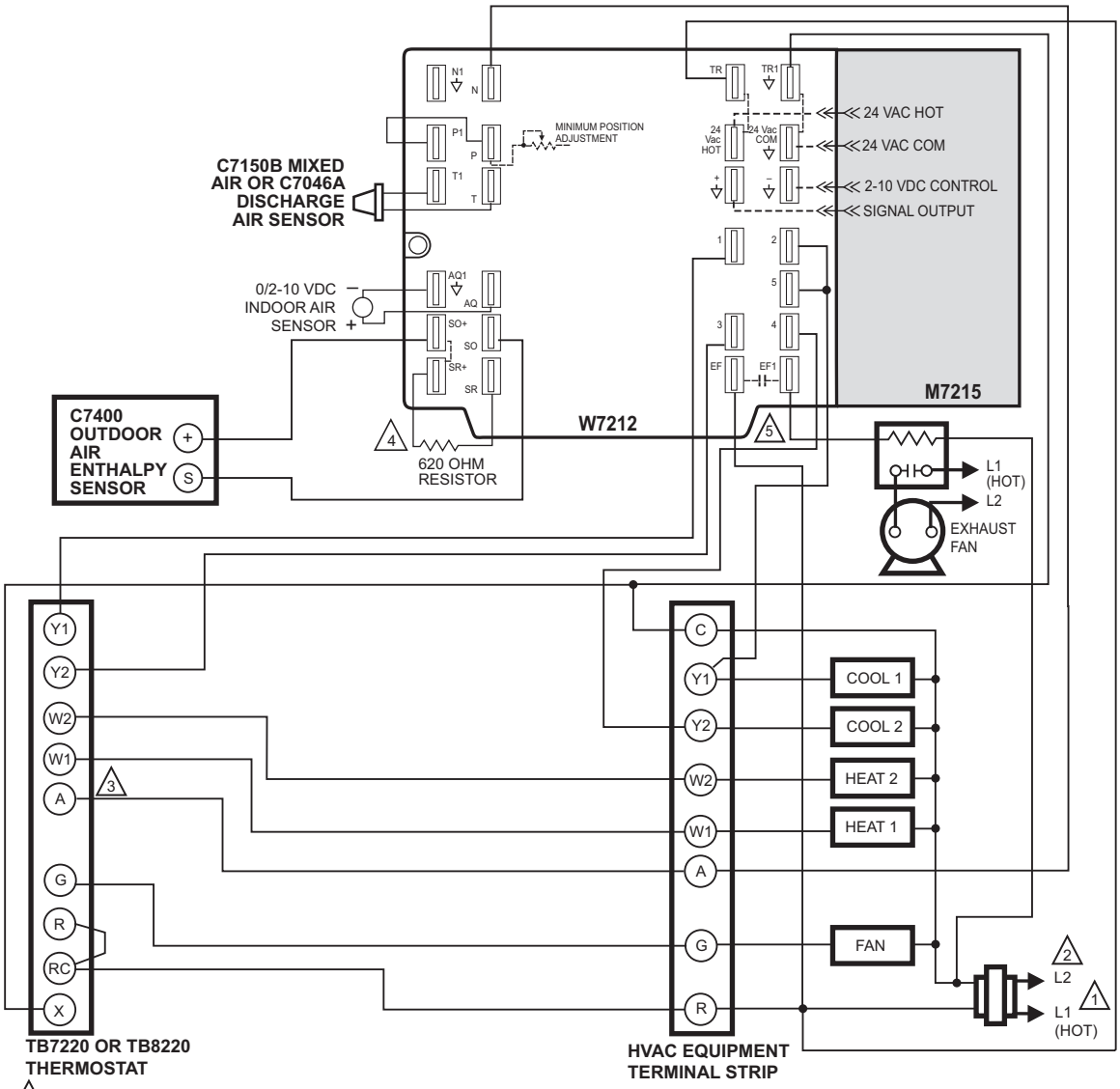
W7212 used with M7215 Damper Motor and T7300 Thermostat



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR. THE SAME TRANSFORMER CAN BE USED FOR THE COMMERCIAL THERMOSTAT AND ACTUATOR.
3. IF SEPARATE HEATING AND COOLING TRANSFORMERS ARE USED, REMOVE JUMPER AT THERMOSTAT. T7350 - TERMINAL “AUX” IS POWERED BY THE HEATING TRANSFORMER (RH). IF POWERING THE ECONOMIZER TERMINAL “N” WITH THE THERMOSTAT TERMINAL “AUX”, BE SURE THE ECONOMIZER IS POWERED BY THE SAME TRANSFORMER AS TERMINAL “AUX”. IF NOT, USE AN ISOLATION RELAY TO POWER “N”.
4. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
5. EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

M13657A

W7212 used with M7215 Damper Motor and T7350 Thermostat



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR. THE SAME TRANSFORMER CAN BE USED FOR THE COMMERCIAL THERMOSTAT AND ACTUATOR.

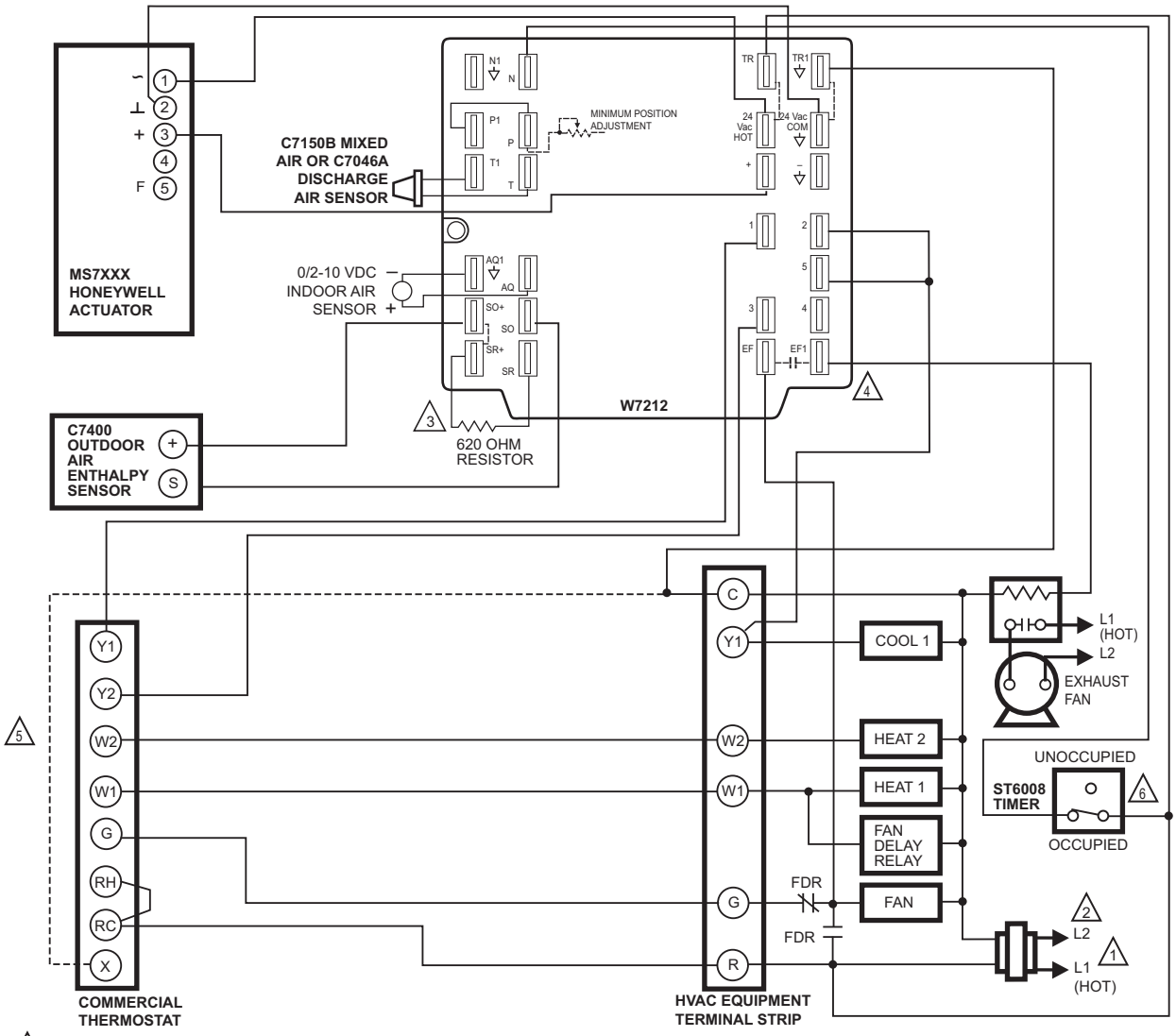
3 IF SEPARATE HEATING AND COOLING TRANSFORMERS ARE USED, REMOVE JUMPER AT THERMOSTAT.
TB7220 - TERMINAL "A" IS POWERED BY THE COOLING TRANSFORMER (RC).
TB8220 - TERMINAL "A" IS POWERED BY THE HEATING TRANSFORMER (R).
IF POWERING THE ECONOMIZER TERMINAL "N" WITH THE THERMOSTAT TERMINAL "A", BE SURE THE ECONOMIZER IS POWERED BY THE SAME TRANSFORMER AS TERMINAL "A". IF NOT, USE AN ISOLATION RELAY TO POWER "N".

4 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.

5 EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

M13658A

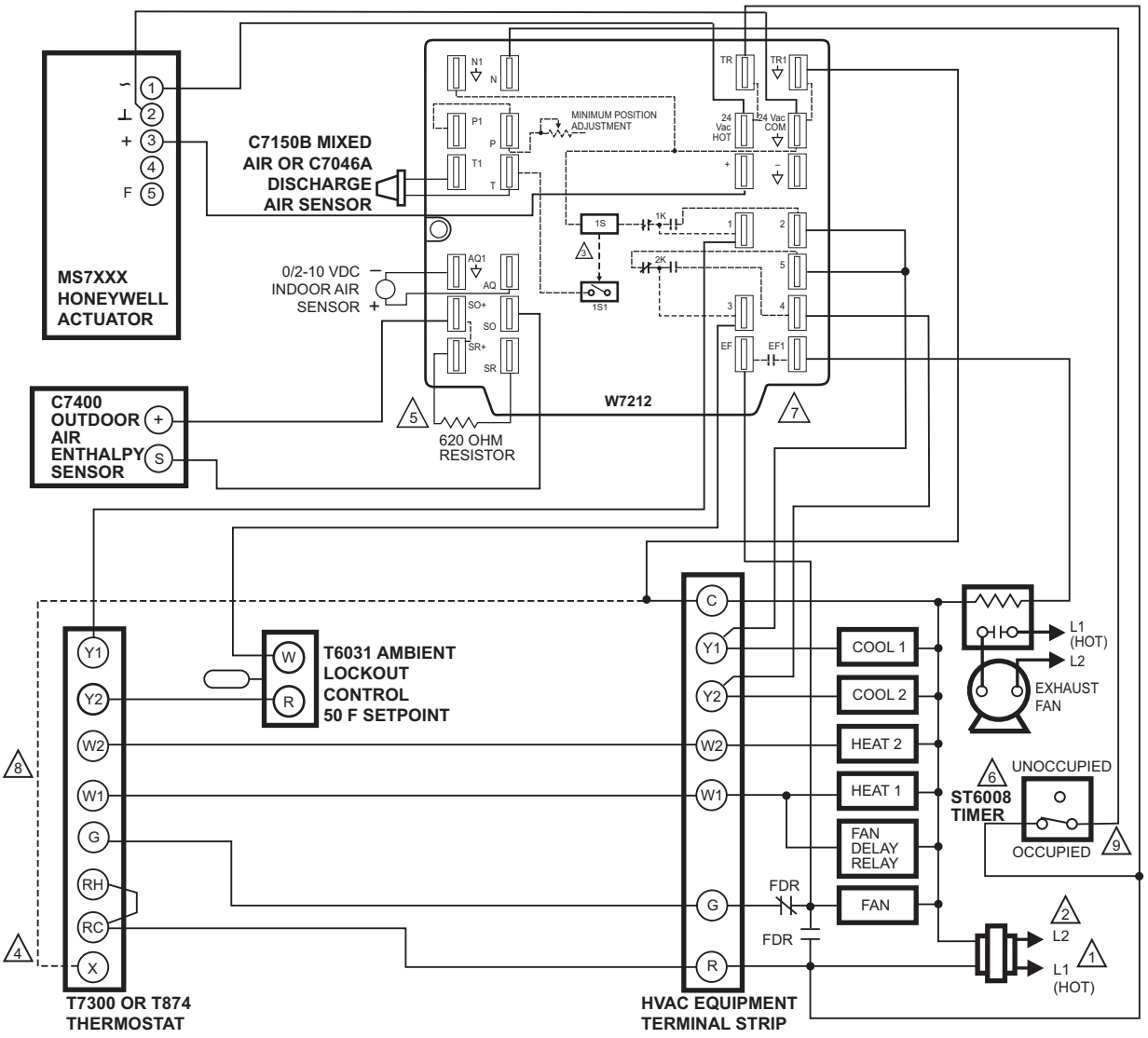
W7212 used with M7215 Damper Motor and TB7220 or TB8220 Thermostats



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
3. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
4. EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.
5. SEE WIRING DIAGRAMS FOR T7350 AND TB7220/TB8220.
6. TIME CLOCK IS AN OPTION TO USING OCCUPIED CONTACTS ON THE COMMERCIAL THERMOSTAT.

M13659A

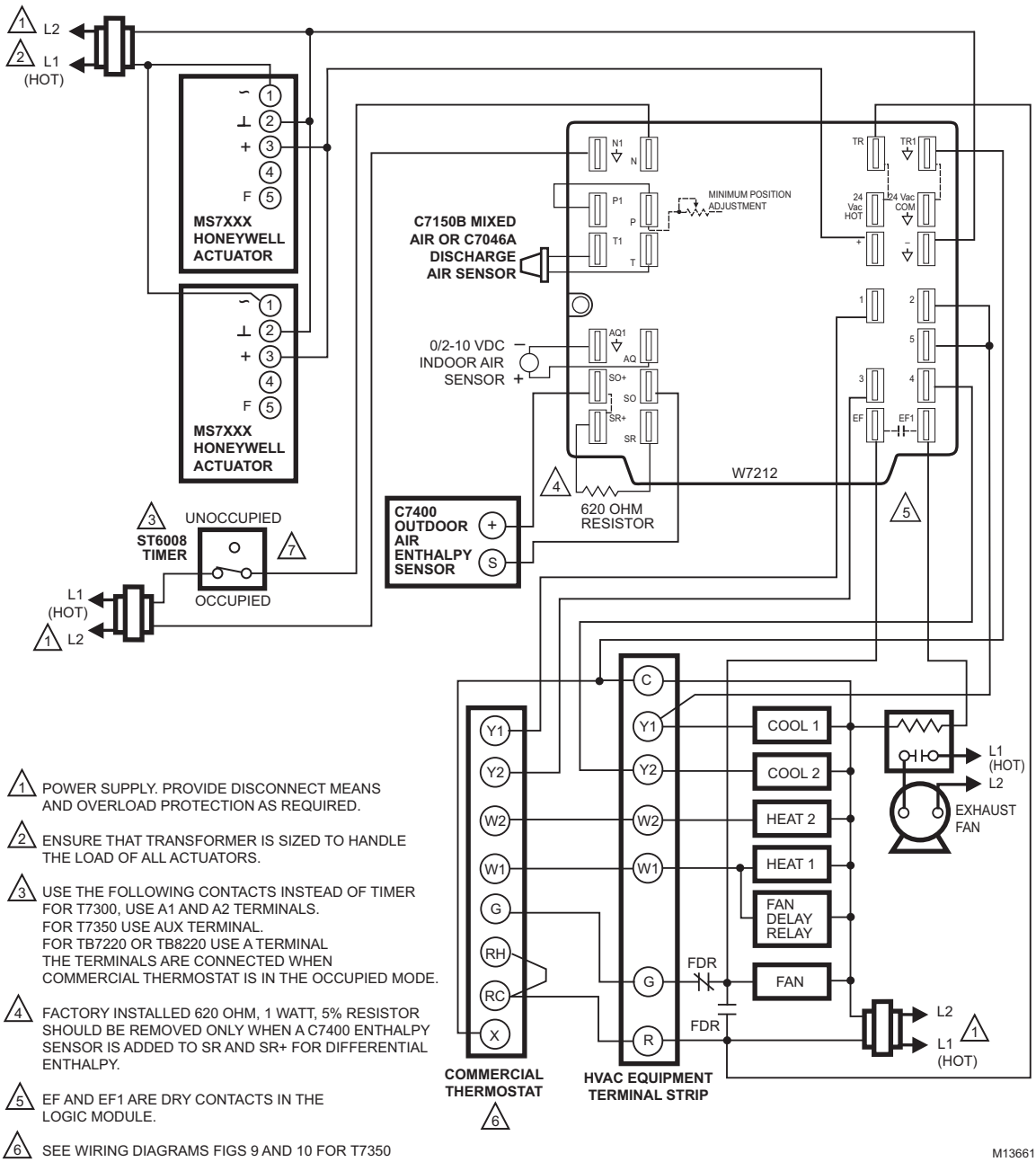
W7212A used in single-stage cooling system with single enthalpy changeover and Honeywell actuator and time clock for occupancy



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
3. 1S IS AN ELECTRONIC SWITCH THAT CLOSES WHEN POWERED BY A 24 VAC INPUT.
4. FOR T7300 ONLY
5. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO SR AND SR+ FOR DIFFERENTIAL ENTHALPY.
6. USE THE FOLLOWING CONTACTS INSTEAD OF TIMER
   FOR T7300, USE A1 AND A2 TERMINALS.
   FOR T7350 USE AUX TERMINAL.
   FOR TB7220 OR TB8220 USE A TERMINAL
   THE TERMINALS ARE CONNECTED WHEN THERMOSTAT IS IN THE OCCUPIED MODE.
7. EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.
8. SEE WIRING DIAGRAMS FIGS 9 AND 10 FOR T7350 AND TB7220/TB8220.
9. TIME CLOCK IS AN OPTION TO USING OCCUPIED CONTACTS ON THE COMMERCIAL THERMOSTAT.

M13660A

W7212A used in two-stage cooling system with Honeywell Series 72 Actuator and time clock for occupancy



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE LOAD OF ALL ACTUATORS.

3 USE THE FOLLOWING CONTACTS INSTEAD OF TIMER
FOR T7300, USE A1 AND A2 TERMINALS.
FOR T7350 USE AUX TERMINAL.
FOR TB7220 OR TB8220 USE A TERMINAL
THE TERMINALS ARE CONNECTED WHEN
COMMERCIAL THERMOSTAT IS IN THE OCCUPIED MODE.

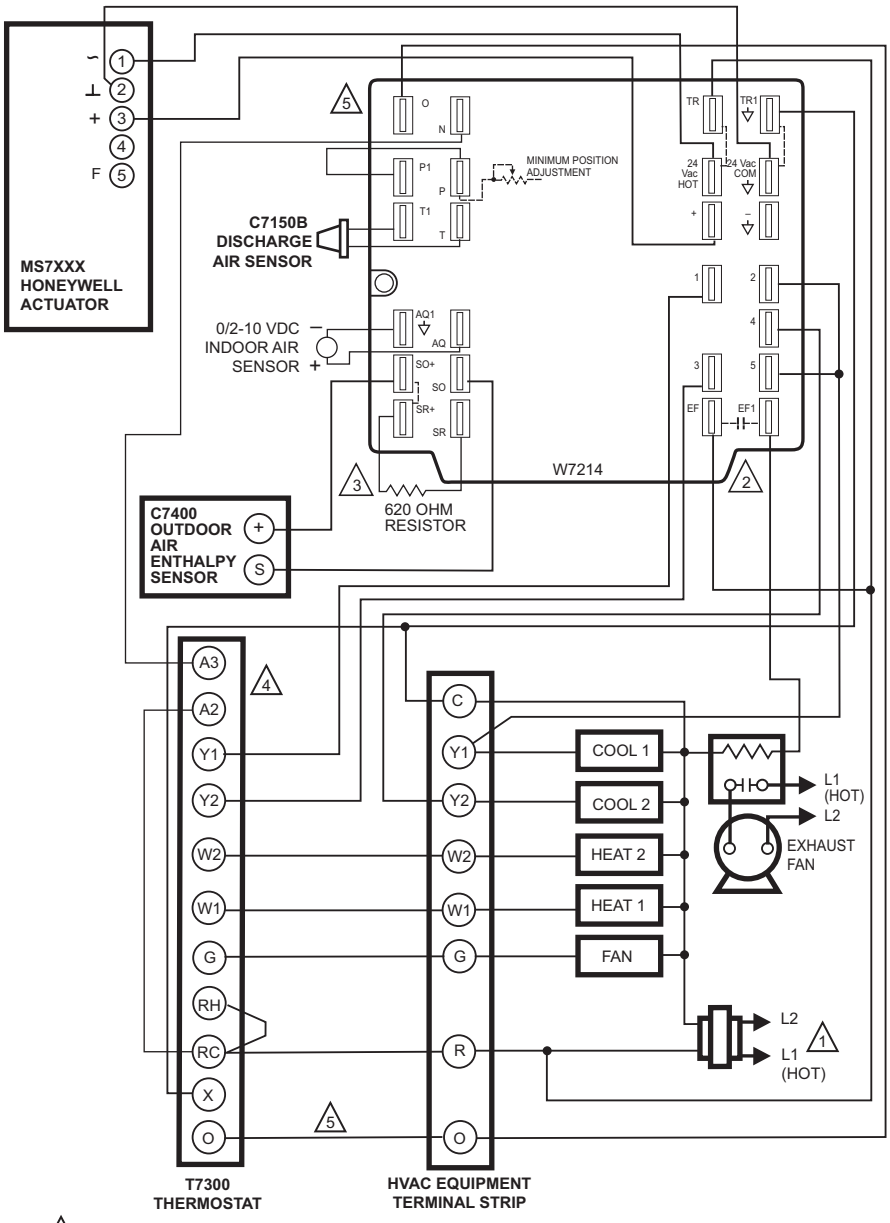
4 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO SR AND SR+ FOR DIFFERENTIAL ENTHALPY.

5 EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

6 SEE WIRING DIAGRAMS FIGS 9 AND 10 FOR T7350 AND TB7220/TB8220.

7 TIME CLOCK IS AN OPTION TO USING OCCUPIED CONTACTS ON THE COMMERCIAL THERMOSTAT.

W7212 controlling parallel-wired Honeywell Series 72 Actuators and time clock for occupancy



1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

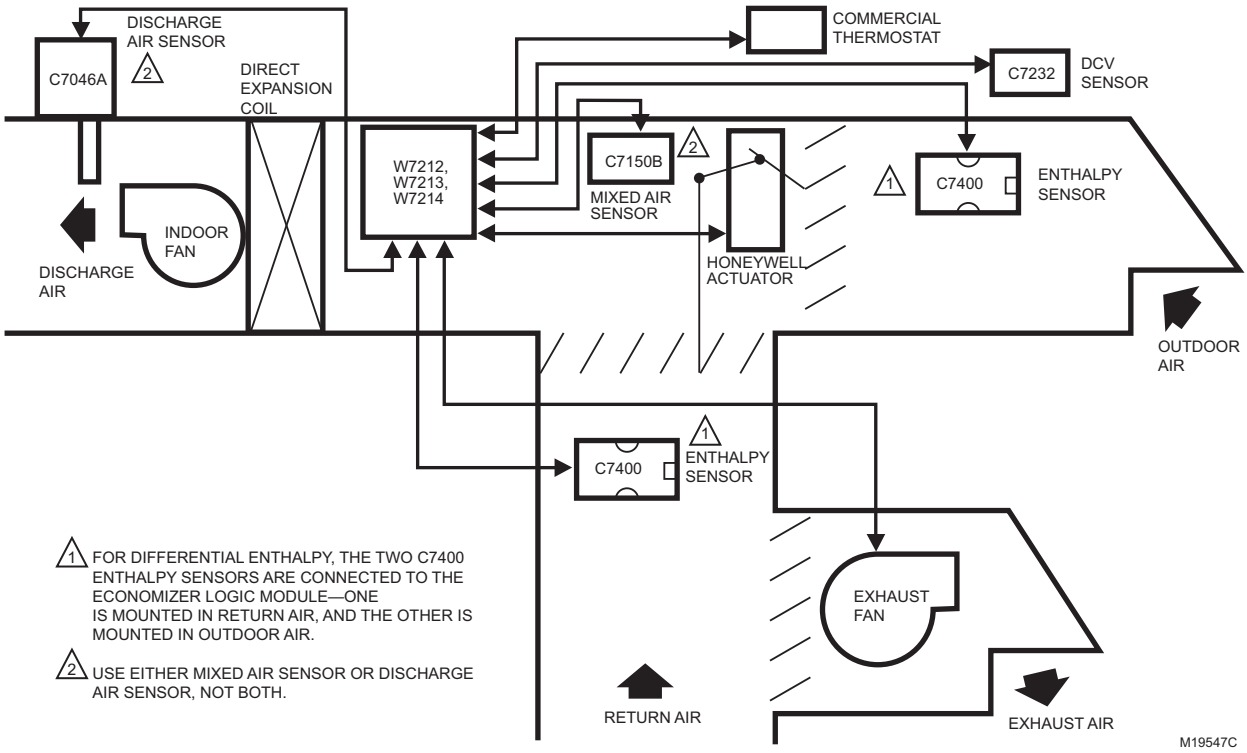
3 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD BE REMOVED ONLY WHEN A C7400 ENTHALPY SENSOR IS ADDED TO SR AND SR+ FOR DIFFERENTIAL ENTHALPY.

4 T7300 TERMINALS A2 AND A3 ARE CONNECTED WHEN THERMOSTAT IS IN THE UNOCCUPIED MODE. SEE T7350 AND TB7220/TB8220 WIRING.

5 W7213: B TERMINAL
W7214: O TERMINAL

M19618D

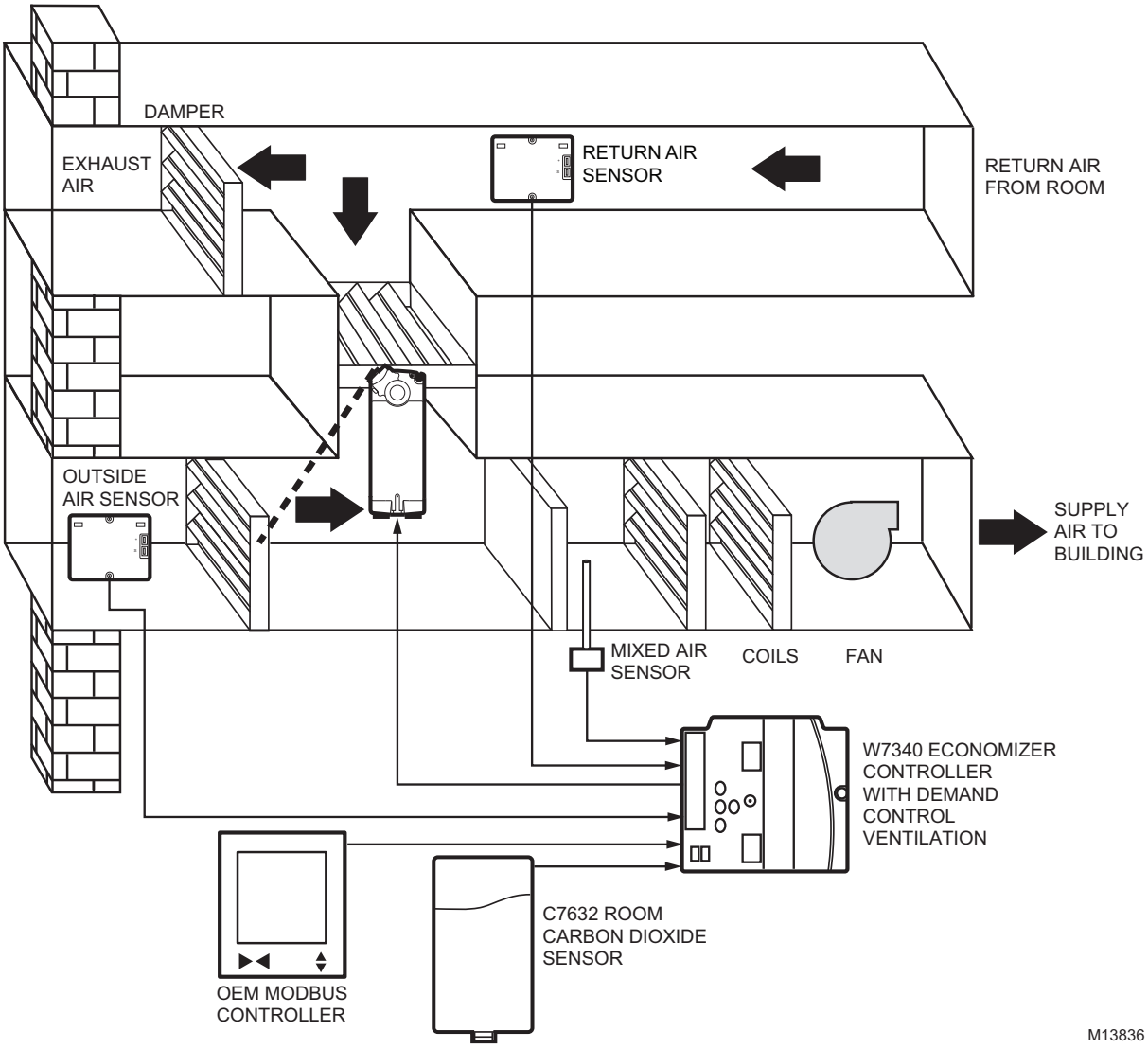
W7213, W7214 controlling heat pump system

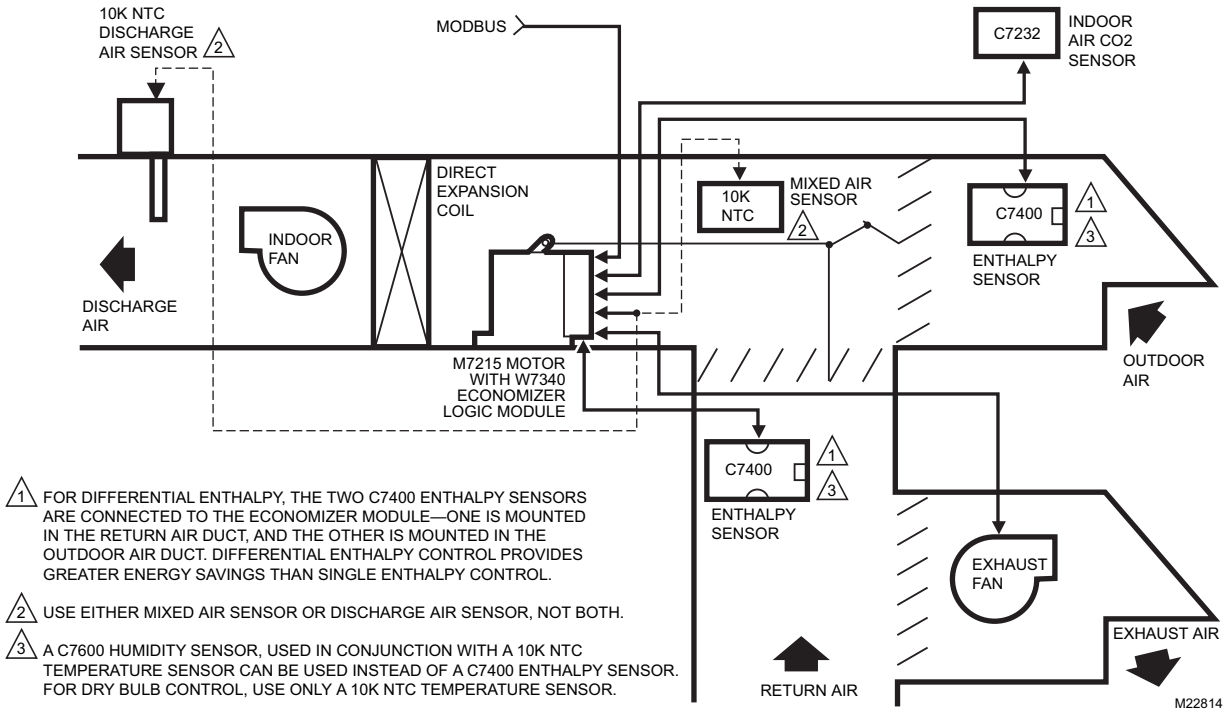


Representative locations of connected economizer system devices

Section 9 - W7340 and W7345 Economizer Module

W7340 Economizer System Components



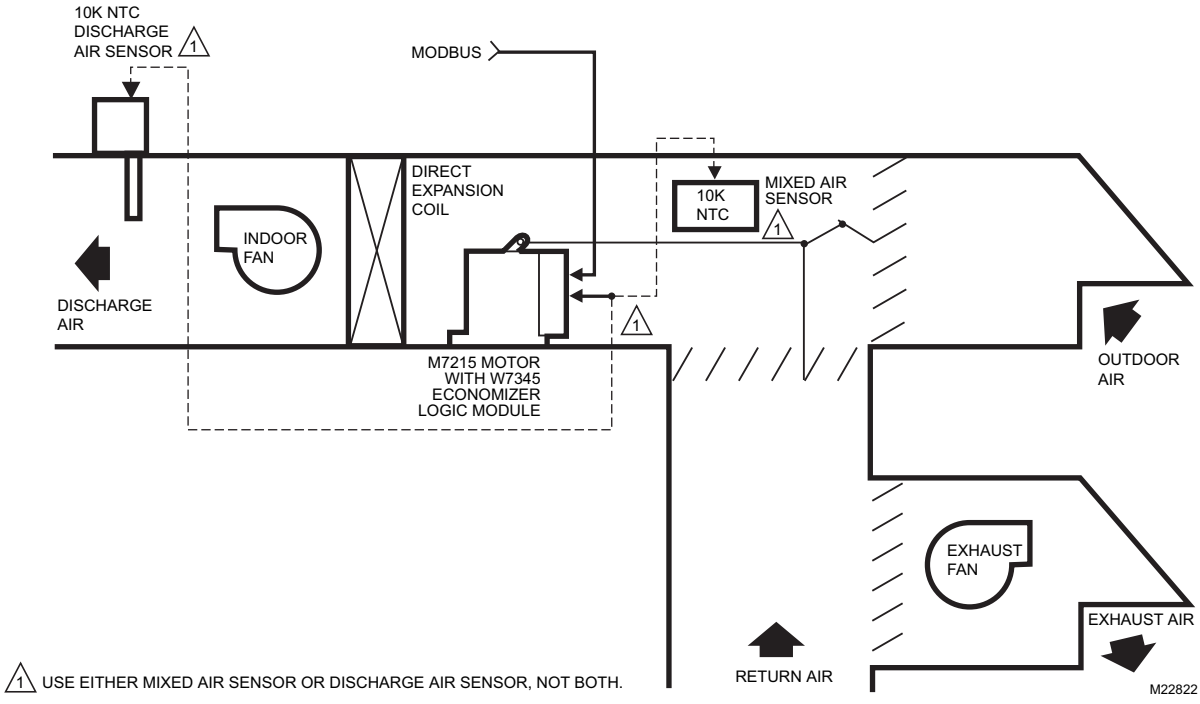


1 FOR DIFFERENTIAL ENTHALPY, THE TWO C7400 ENTHALPY SENSORS ARE CONNECTED TO THE ECONOMIZER MODULE—ONE IS MOUNTED IN THE RETURN AIR DUCT, AND THE OTHER IS MOUNTED IN THE OUTDOOR AIR DUCT. DIFFERENTIAL ENTHALPY CONTROL PROVIDES GREATER ENERGY SAVINGS THAN SINGLE ENTHALPY CONTROL.

2 USE EITHER MIXED AIR SENSOR OR DISCHARGE AIR SENSOR, NOT BOTH.

3 A C7600 HUMIDITY SENSOR, USED IN CONJUNCTION WITH A 10K NTC TEMPERATURE SENSOR CAN BE USED INSTEAD OF A C7400 ENTHALPY SENSOR. FOR DRY BULB CONTROL, USE ONLY A 10K NTC TEMPERATURE SENSOR.

Representative Locations of Connected W7340 Economizer System Devices



1 USE EITHER MIXED AIR SENSOR OR DISCHARGE AIR SENSOR, NOT BOTH.

Representative Locations of Connected W7345 Economizer System Devices

W7340 and W7345 Components

The W7340 is a full enthalpy economizer used in an OEM unit to provide a totally integrated control system.

The W7345 provides temperature (OAT) control only; it does not have an option for a RAT, DCV sensor or exhaust control.

The W7340, when wired as shown below responds to a signal from a modified Modbus command. This system uses C7400 Solid State Enthalpy Changeover Sensor(s). The C7400 Enthalpy Sensors respond to both dry bulb temperature and humidity, allowing use of outdoor air at higher temperatures for free cooling when humidity is low.

The logic module functions as a first stage of cooling and provides maximum energy savings during the cooling cycle. The logic module automatically locks out free cooling during heating and holds the outdoor air damper at the DCV minimum setting.

Table 1 details the input/output (I/O) logic of the W7340. The logic module energizes the Unit Control and Indoor Fan contacts, and operates according to Table 1.

Table 1. W7340 Economizer I/O Logic.

Inputs					Outputs		
	Enthalpy[a]				Compressor		
DCV	Outdoor	Return	Y1[b]	Y2[b]	Stage 1	Stage 2	Damper
Below set	High	Low	On	On	On	On	Minimum position
			On	Off	On	Off	
	Low	High	On	On	On	Off	Modulating[c]
			On	Off	Off	Off	
Above set	High	Low	On	On	On	On	Modulating[d]
			On	Off	On	Off	
	Low	High	On	On	On	Off	Modulating$_e$
			On	Off	Off	Off	

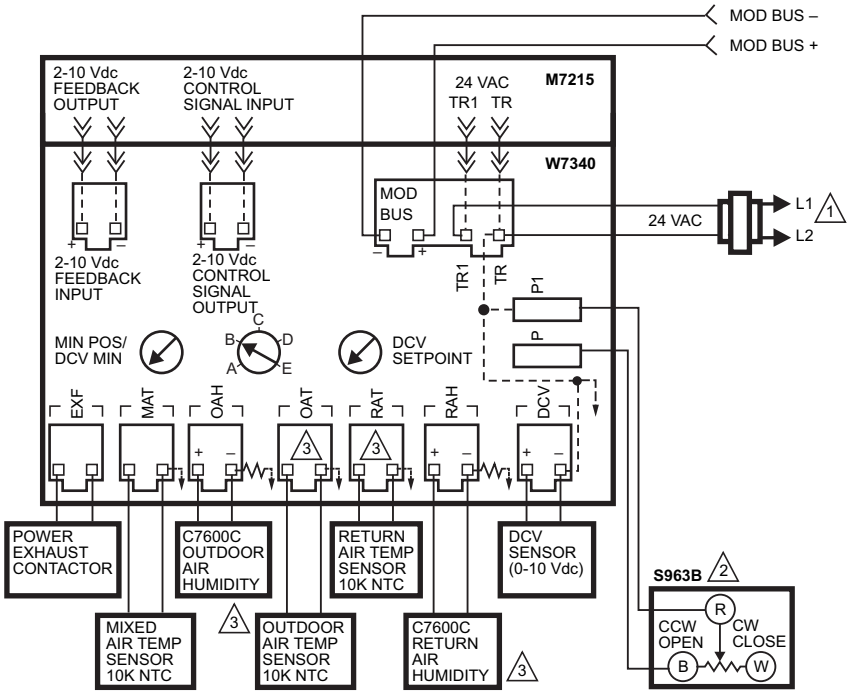
[a] For single enthalpy control, the module compares outdoor enthalpy to the ABCDE setpoint.

[b] If both stages of cooling are off, the system is off and the damper is:
- — At DCV minimum position if DCV is below setpoint.
- — Modulating if DCV is above setpoint.

[c] Modulation based on mixed air sensor signal, modulating between DCV minimum position and 100% open.

[d] Modulation based on DCV signal, limited by minimum position.

[e] Modulation based on the greater of the DCV and mixed air sensor signals.



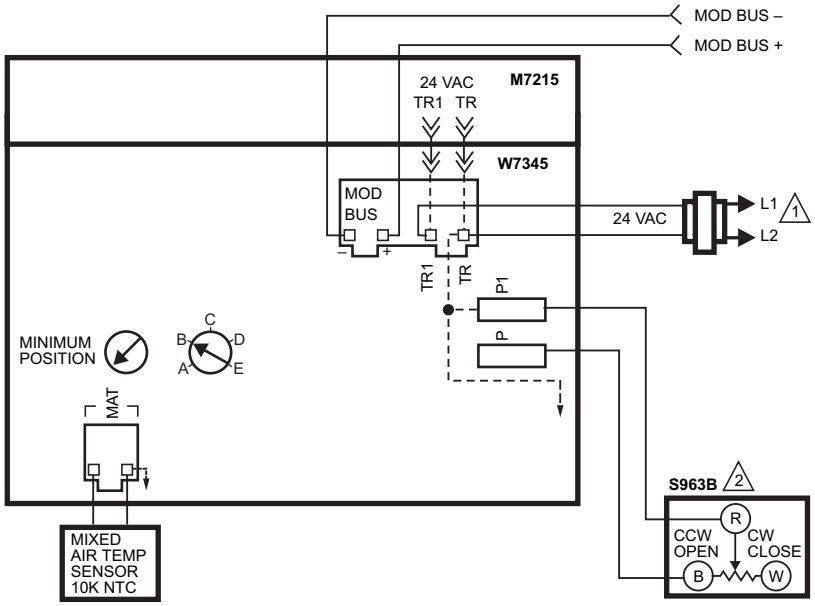
1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 OPTIONAL REMOTE MINIMUM POSITION POTENTIOMETER.

3 WHEN USING C7400 ENTHALPY SENSORS, CONNECT THE ENTHALPY SENSOR TO THE HUMIDITY SENSOR TERMINALS. LEAVE THE TEMPERATURE SENSOR TERMINALS EMPTY.

M23875

W7340 Typical Wiring



1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 OPTIONAL REMOTE MINIMUM POSITION POTENTIOMETER.

M23876

W7345 Typical Wiring

W7340 only

To measure enthalpy, the logic module accepts signals from either:
- C7600C Humidity and 10K NTC temperature sensors.
- or a C7400 Enthalpy Sensor.
- OR from the OEM controller vis a modified Modbus communications link.

When using C7400 Enthalpy Sensors; connect the enthalpy sensors to the humidity sensor terminals; leave the temperature sensor terminals empty.
- Use C7400A sensor with W7340A or W7340B.
- Use a C7400C sensor with W7340C.

The local method (changing configuration from Modbus) of configuring the Economizer for enthalpy or humidity sensors is:
- Short out the external minimum damper position terminals during the first three seconds after boot-up will cause the LED to go solid on within 5 seconds.
- Maintain the short for another 5 seconds will cause LED to flash quick pulses, indicating the type of configuration.
- 2 pulses between off periods indicates the Economizer is configured for Humidity sensors. 3 pulses means it is configured for Enthalpy sensors.

The configuration can be toggled between Humidity and Enthalpy by releasing the short for approximately 5 seconds, until the LED goes solid again, and then reapplying the short for another 5 seconds.

The toggling is indicated by the new LED flash sequence. This can be performed as many times as desired, and the most recent configuration will be saved when the short is removed for over 10 seconds.

Demand Control Ventilation (DCV) Sensor Input (W7340 only)

The DCV sensor can be any sensor that provides a 2-10 Vdc output over a range of 500 to 1500 ppm of CO_2. The DCV signal modulates the outdoor damper to provide ventilation based on occupancy.

The W7340A and B modules do not have the ability to set the outdoor air damper to a maximum position for DCV, they incorporate a minimum position setting that defaults to 20% but can be overridden using the on-board pot or the modified Modbus communication link to a maximum of 50% open.

The maximum position sets the damper position to a position that the damper goes to if the CO_2 sensor fails. If the minimum position set point is higher than the DCV maximum position, on sensor failure, the damper goes to the higher of the two of DCV maximum and minimum position setting.

There is no limit on the damper position on a call from the CO_2 sensor (DCV). It can go 100% open.

The W7340C DCV economizer logic module has the ability to set DCV minimum damper and minimum position. The DCV minimum position is set to ventilate the building contaminants and the minimum position is set to ventilate for the building contaminants and the building occupants. The installer sets the damper DCV minimum position and the minimum position based on the design occupancy and cfm of outdoor air requirements for the space. The damper will modulate open between the DCV minimum damper position and the minimum position based on input from a CO_2 sensor. The damper will not drive 100% open on a call for ventilation, but can drive 100% open on a call for cooling. If the CO_2 sensor fails the damper

will drive to the minimum position ventilating for building contaminants and the building occupants.

The W7340C does not have a separate potentiometer to select the new DCV minimum damper position. The following procedure allows the installer to set the new DCV minimum position.

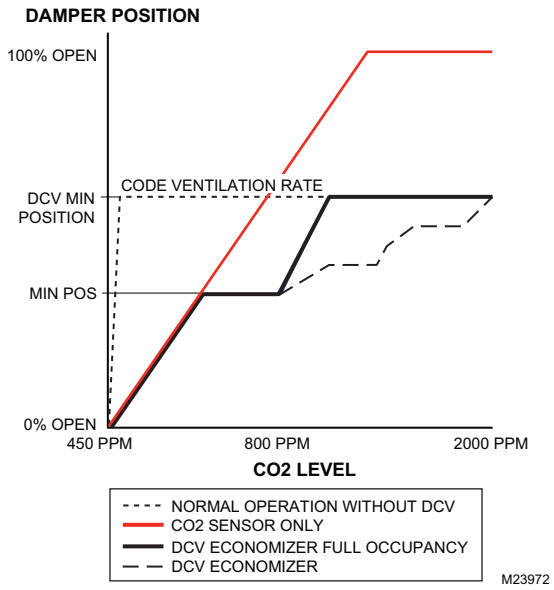
DCV Minimum and Minimum Position Damper Set Up

Set up instructions for W7340C DCV damper positions:

1. Remove RAT sensor from RAT terminals.
2. Connect CO_2 sensor to DCV terminals.
3. Apply power to economizer logic module.
4. Wait 10 to 15 seconds for the CO_2 sensor to initialize. Short RAT terminals.
5. Remove CO_2 sensor from DCV terminals.
6. DCV LED will blink 2 times. If LED does not blink, cut power to economizer logic and repeat steps 1-5.
7. Set DCV minimum position using MIN POS/DCV MIN potentiometer.
8. Remove RAT short.
9. DCV minimum position is saved to memory and DCV LED blinks 5 times.
10. Turn off power to economizer logic module.
11. Connect RAT sensor.
12. Turn power on to economizer logic module.
13. Set minimum position using MIN POS/ DCV MIN

IMPORTANT

Steps 3-8 must be completed within 3 minutes after power up otherwise the configuration process will be terminated, no changes will be saved and you will need to repeat steps 1-13.



W7340 Demand Control Ventilation

The W7215 and W7212 have minimum position for the Building contaminants and DCV maximum for the total ventilation required by design.

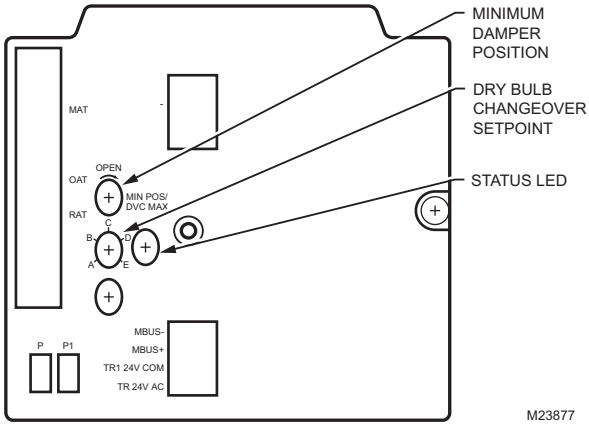
The W7340C has different labels for the same functions. DCV minimum is the same as the W7212 minimum position and the minimum position for W7340C is the DCV maximum on the W7212.

It is VERY IMPORTANT to know the difference between the various suppliers equipment as what they are referring to in their control language.

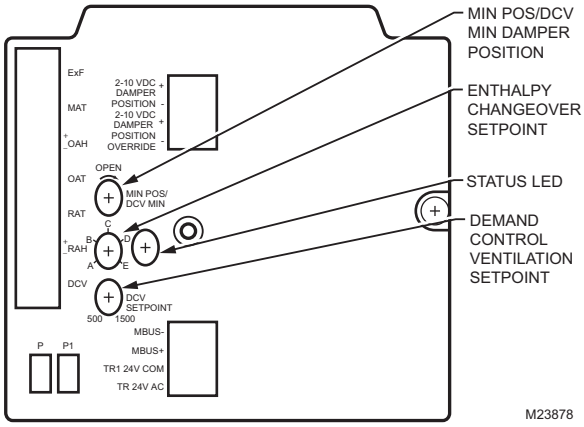
Settings and Adjustment

W7345

Potentiometers located on the face of the W7345, provide adjustments for Minimum Damper Position parameters (see below).



Location of W7345 potentiometers and LED



Location of W7340 potentiometers and LED

W7340

Using the DCV potentiometer, the setpoint can be adjusted until three minutes after powering the device. Through the Modbus, the DCV setpoint can be modified at any time. If the DCV potentiometer is changed after the three minute power-up time, no change to the DCV setpoint will occur unless power is removed from the device then reapplied.

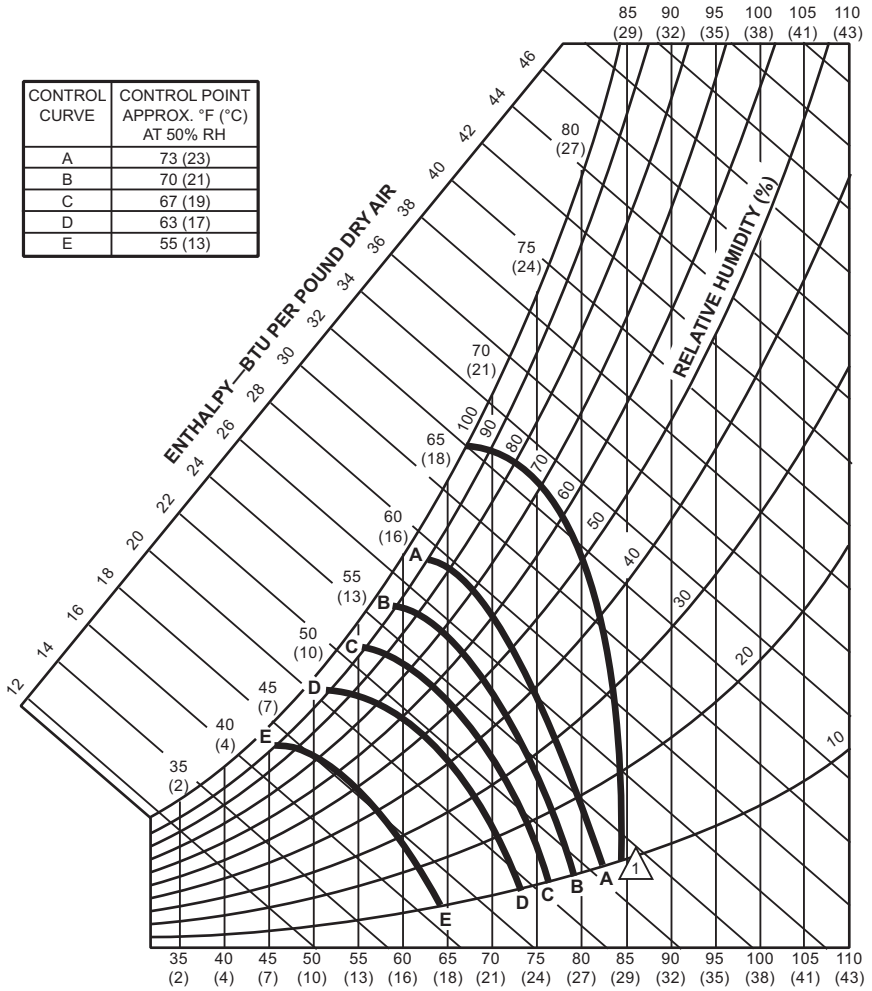
If the mixed air temperature drops to 45°F (7°C), the mixed air sensor overrides the DCV sensor and closes the damper to DCV minimum position to protect the hot or chilled water coils from freezing. When the mixed air temperature rises to 48°F (9°C), control reverts to normal operation.

Exhaust Setpoint (W7340 only)

The exhaust setpoint determines when the exhaust fan will run based on the damper position, this function is the same as the exhaust setpoint on the W7215 and W7212 except, as shipped from the factory, the W7340 uses an exhaust setpoint of 25%. When the damper position is greater than 25% open (from fully closed), the logic module calls for exhaust. When the damper position is below 22% open, the relay is de-energized.

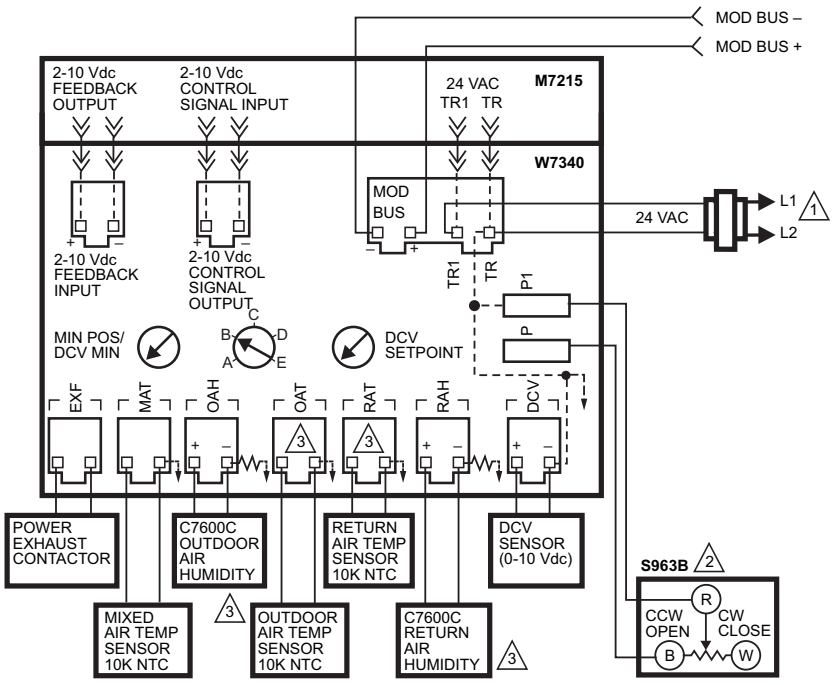
The W7340C has an E curve in addition to the A, B, C and D curves. See the chart below showing location of E curve on Psychrometric chart.

CONTROL CURVE	CONTROL POINT APPROX. °F (°C) AT 50% RH
A	73 (23)
B	70 (21)
C	67 (19)
D	63 (17)
E	55 (13)



W7340 Performance Characteristics for Enthalpy Changeover Settings

Wiring for W7340 and W7345



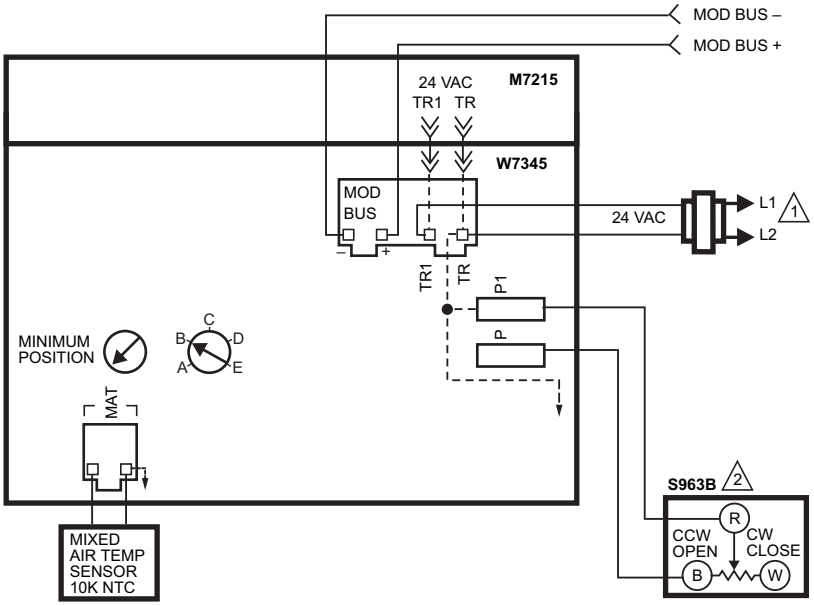
1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 OPTIONAL REMOTE MINIMUM POSITION POTENTIOMETER.

3 WHEN USING C7400 ENTHALPY SENSORS, CONNECT THE ENTHALPY SENSOR TO THE HUMIDITY SENSOR TERMINALS. LEAVE THE TEMPERATURE SENSOR TERMINALS EMPTY.

M23875

W7340 Typical Wiring



1 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 OPTIONAL REMOTE MINIMUM POSITION POTENTIOMETER.

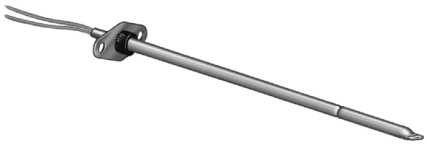
M23876

W7345 Typical Wiring.

Section 10 - Sensors for Economizer Modules

Temperature

C7650



C7046

C7150

Carbon Dioxide

C7242

C7632

C7232

Enthalpy

C7400

Sensor Features

Sensor Series	Type of Sensor	Application	Comments	Specific Product Number
C7046	Temperature	Discharge Air		C7046A1004
				C7046A1038
C7150	Temperature	Mixed Air		C7150B1004
			OEM	C7150B1012
			OEM	C7150B1020
			For Use with W957F	C7150B1038
C7400	Enthalpy Sensor	Enthalpy Changeover		C7400A1004
			OEM	C7400A1012
			OEM	C7400A1038
			OEM	C7400A1046
C7650	Temperature	Dry Bulb Changeover		C7650A1001
			OEM	C7650A1027
C7242	Carbon Dioxide	Indoor Wall Mount	Display, Relay Output	C7242A1030
		Indoor Wall Mount	No Display, Relay Output	C7242A1048
		Indoor Wall Mount	Display	C7242A1014
		Indoor Wall Mount	No Display	C7242A1022
		Duct Mount	Display	C7242B1012
		Duct Mount	No Display	C7242B1020
		Portable	Display, Batteries	C7242C1002
		Wall Mount	Display	C7242D1000
		Duct Mount	Display	C7242D1018
		Outside Air		C7242E1007
C7232		Indoor Wall Module	Display, Relay Output	C7232A1008
		Indoor Wall Module	No Display, Relay Output	C7232A1016
		Indoor Wall Mount	Display, No Honeywell Logo, Relay Output	C7232A1024
		Indoor Wall Mount	No Display, No Honeywell Logo, Relay Output	C7232A1032
		Duct Mount	Display	C7232B1006
		Duct Mount	No Display	C7232B1014
		Duct Mount	Display, No Honeywell Logo	C7232B1022
		Duct Mount	No Display, No Honeywell Logo	C7232B1030
C7632		Wall Mount	No Display, No Adjustment Settings	C7632A1004
		Duct Mount	No Display, No Adjustment Settings	C7632B1002

Type of Sensors for Economizer

The C7400 enthalpy sensor combines temperature and humidity measurements into a single device. The output is 4 to 20 mA. All sensing elements are solid state electronics which have been determined to be durable over more than fifteen years of usage. There are no setpoints on the sensor since all adjustments are done on the control module.

C7400 Enthalpy

In some dry, arid climates it may be sufficient to use a dry bulb sensor in place of a C7400 enthalpy sensor to achieve significant savings. The output of the sensor has large dead bands and should only be used in climates where the RH never gets above 5%. The C7650 solid state temperature sensor is used in these applications. The output is 10 to 20 mA. It should not be used with the H705 or the W7459D, W6210D or W7210D advanced economizer modules.

C7650 Temperature

The W7459, W6210, W7210, W6215 and W7215 modules are all provided with sensor connections for either a mixed or supply air sensor to modulate the mixed air dampers. Either the C7046A or C7150B can be used for this function since the resistance curves for both are identical. The C7046A is 8 inches (20 cm) long which makes it a better selection for larger air handlers than the single point C7150B. When installing the C7150B use a simple smoke bomb to determine air flow and locate the sensor in a location where the OA and RA have the best mix. Do not use a smoke bomb in an occupied building.

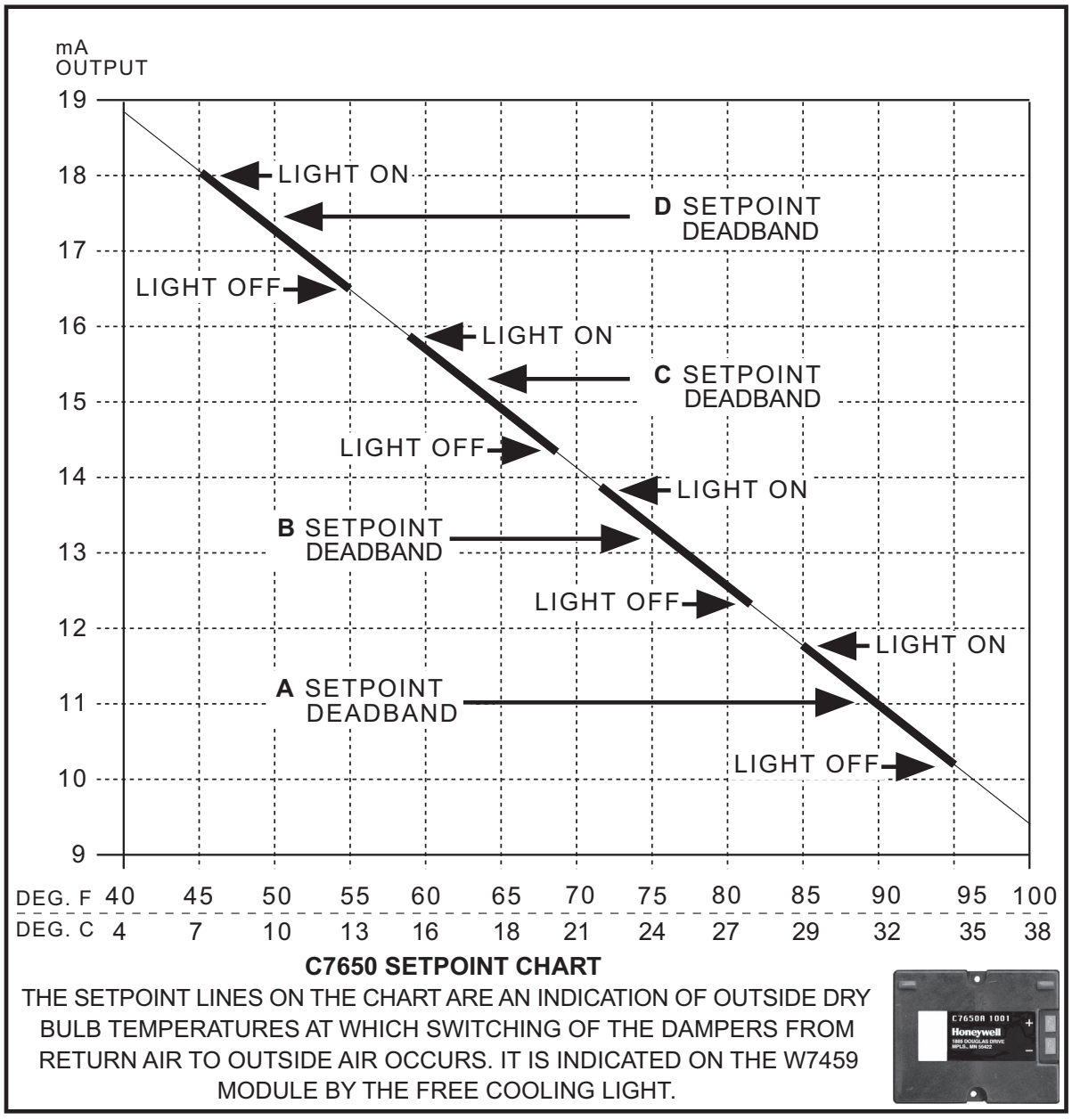
C7046 Temperature

C7150 Temperature

The DCV economizer modules W6215A, W7212, W7340B, W7215A and W7460A can be used with any indoor air content sensor with a 0 or 2 to 10 Vdc output. The W7460B and W7215B are equipped with provisions for indoor and outdoor air content sensors. For most indoor applications Honeywell C7232, C7632 or C7242 carbon dioxide sensors will be used. They are available in either wall or duct mount versions with or without display.

C7242 Carbon Dioxide C7632

C7650 Temperature Sensor



C7650 SETPOINT CHART

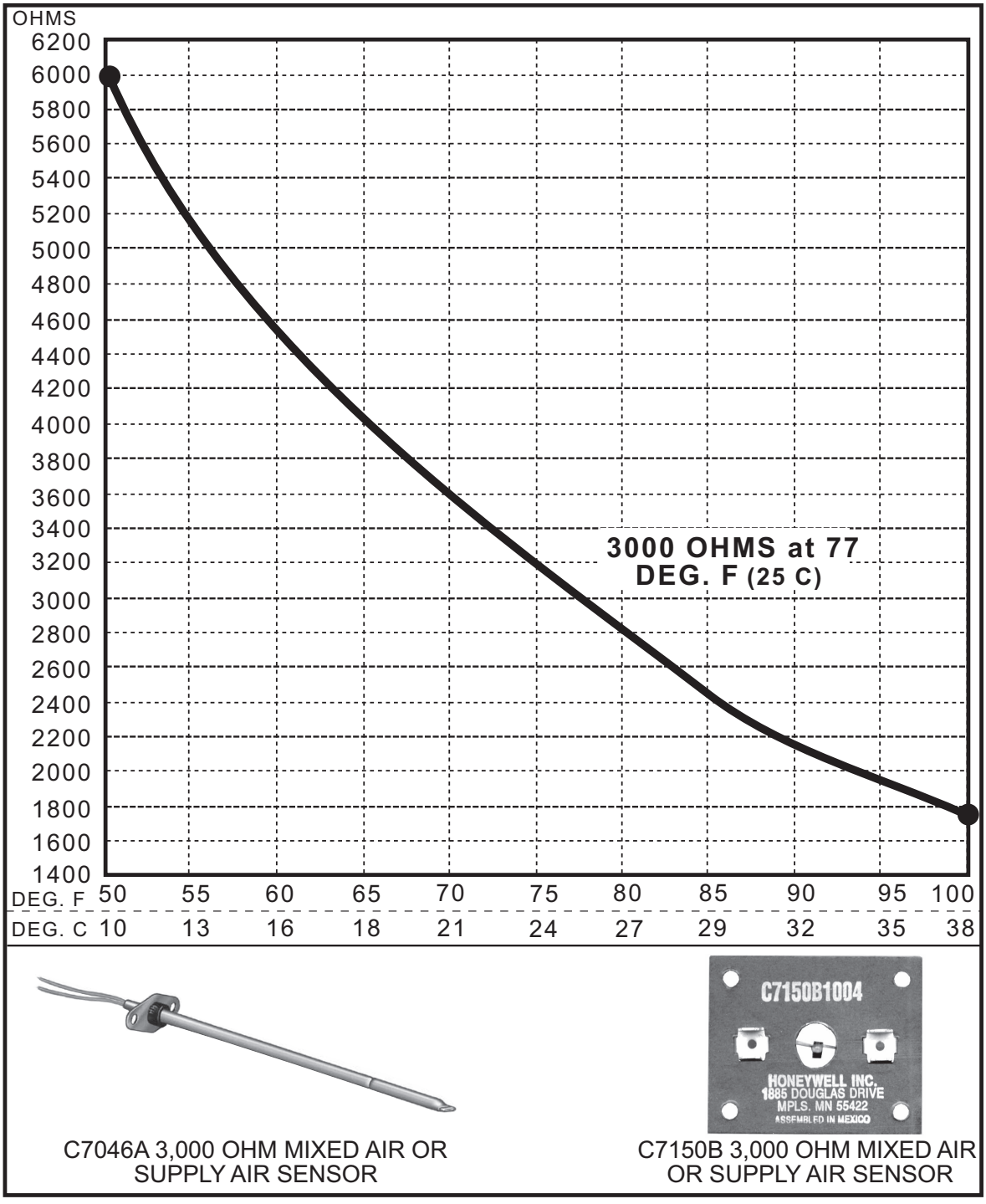
THE SETPOINT LINES ON THE CHART ARE AN INDICATION OF OUTSIDE DRY BULB TEMPERATURES AT WHICH SWITCHING OF THE DAMPERS FROM RETURN AIR TO OUTSIDE AIR OCCURS. IT IS INDICATED ON THE W7459 MODULE BY THE FREE COOLING LIGHT.

M25284

The setpoint dial on the logic modules is labelled A, B, C and D to correspond to various levels on the psychrometric chart on page 52. If the C7650 temperature sensor is used in place of the C7400 enthalpy sensor, the setpoints change to the settings indicated on the chart above. Example: When the B setpoint is chosen, the module will open the outside air damper at approximately 72°F (22°C) when the temperature is decreasing and will close the damper to minimum position and turn on the compressor at 82°F (28°C) when the temperature is increasing.

NOTE: The temperature has to drop below 72°F (22°C) before the economizer will open the damper for free cooling.

C7150 and C7046 Mixed and Supply Air Sensors



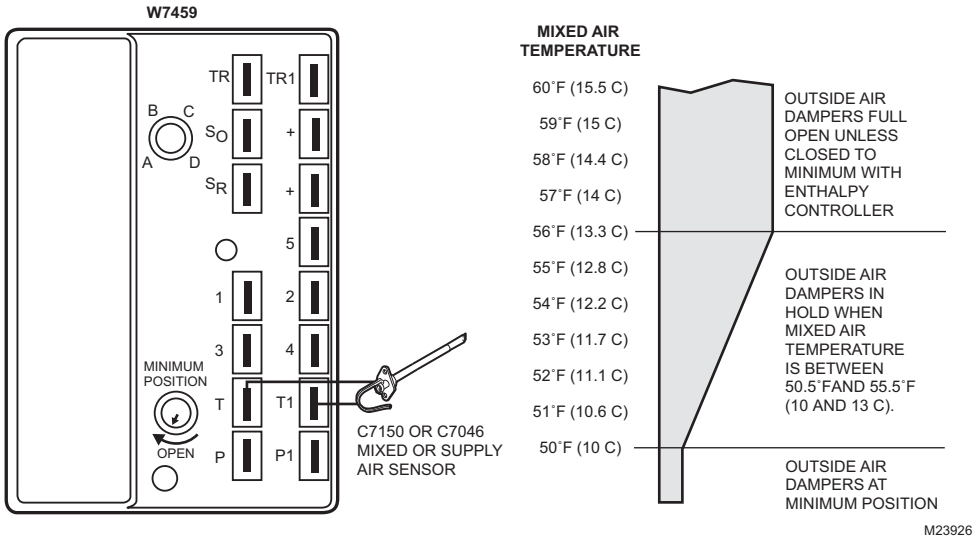
C7046A 3,000 OHM MIXED AIR OR SUPPLY AIR SENSOR

C7150B 3,000 OHM MIXED AIR OR SUPPLY AIR SENSOR

M25285

This chart is for the C7046A or C7150B supply or mixed air sensors designed to be used with all of the economizer logic modules. These sensors have negative temperature coefficients, as the ambient temperature at the sensor increases, the resistance of the sensor decreases. It changes 70 ohms in resistance for every 1°F (0.6°C) change in temperature.

Mixed or Supply Air Sensor Control Sequence



The control sequence for the sensor connected to the mixed or supply (discharge) air temperature terminals on all of the economizer modules is basically the same. The dampers remain at the minimum position until there is a call for cooling from the commercial thermostat. If the mixed or supply air temperature is below the lower end of the setpoint range of 50°F (10°C) the outside air dampers will remain at minimum. If the measured temperature is within the range of 50 to 56°F (10 to 13.3 °C) the outside dampers will not be modulated open or closed. If the mixed air temperature is above 56°F (13.3°C) the outside air dampers will be modulated open until the temperature is within the range or the dampers are full open. If the enthalpy of the outside air is too high, the outside air dampers will be returned to minimum.

Carbon Dioxide Sensor

Honeywell C7632
Carbon Dioxide Sensor

Carbon dioxide (CO_2) is frequently used as the sensor for demand ventilation control. People exhale CO_2 as they breathe. If there is a large number of people in a space the level of CO_2 will increase. When a CO_2 sensor is installed in the space, a signal is sent to the air handler mixed air control which modulates the outside air dampers. The required ventilation volume for a room increases when occupancy increases. When people leave the space, CO_2 levels will decrease and the outside air dampers close to a more economical setting. Ventilation cost can be controlled by using CO_2 sensing in addition to economizer functions.

An indoor air quality analysis should be done to evaluate the air quality in a building. Analysis of all compounds in addition to carbon dioxide is required to evaluate the overall healthiness of a building. Contaminants, such as volatile organic compounds, are not detected with a CO_2 sensor. Complex electronic equipment is required to fully test for the presence of all the various compounds which may be in the air supply. CO_2 sensor based ventilation control is a modern enhancement to economizer control circuits, not a substitute for a total professional air quality evaluation of a building.

If you have a building with a high concentration of a gas other than CO_2, consider using the IAQP ventilation method but always consult a professional trained in control of gases.

Section 10 - Sensors for Economizer Modules

Section 11 - Checkout

Honeywell has a checkout procedure for every economizer logic module. The checkout procedures are listed in the back of the product data sheet shipped with every economizer or can be found at customer.honeywell.com.

On the bottom right part of the home page (see figure shown at the left) you will find the Literature/Image Search box. Type in your Honeywell Order Specification number (W7212) and click on the red arrow. All the literature associated with the model will appear. For checkout procedures select a document with “Product Data” listed in the Type column (see image below). The checkout section is located at the back of the document.

File	Rev	Model	Description	Date	Type
63-1297 PDF File	2	W7212, W7213, W7214	Economizer Logic Modules for Ventilation Control	7-03	Specification Data
63-2596 PDF File	4	W7212, W7213, W7214	Economizer Logic Modules for Ventilation Control	9-05	Product Data
63-2484 PDF File	2	C7046C, C7150B, C7400A, C7650A, M7415, M8405, MS7505, T6031H, W7212, W7459	Solid State Economizer System	8-06	Product Data
63-2576 PDF File	1	C7046C, C7150B, C7232, C7632, C7400A, C7650, M7215, W7212, W7213, W7214	Solid State Eonomizer System (consisting of:)	7-04	Product Data

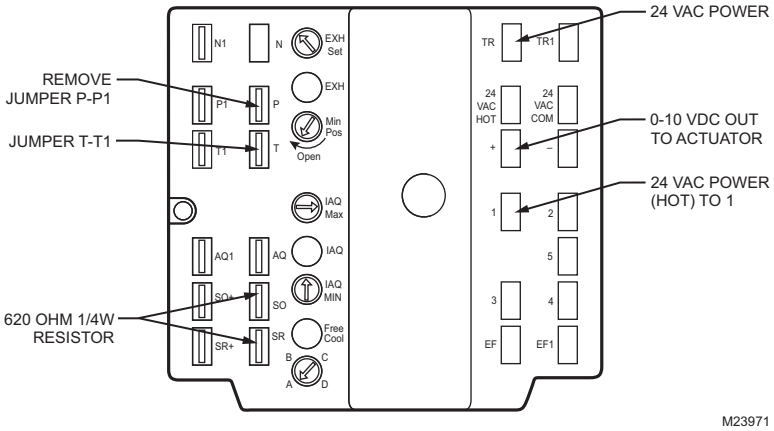
Standard Checkout Procedure

Table 3. Checkout for W7212, W7213, W7214 Economizers Connected to Honeywell Actuator.

Step	Checkout Procedure	Proper Response
1.	CHECKOUT PREPARATION	
	Disconnect power at TR and TR1.	All LED are off; Exhaust Fan contacts are open.
	Disconnect devices at P and P1.	
	Jumper P to P1.	
	Place 5.6K ohm resistor across T and T1.	
	Jumper TR to 1.	
	W7212 *only*: Jumper TR to N.	
	If connected, remove C7400 Enthalpy Sensor from terminals S_O and +.	
	Connect 1.2K ohm 4074EJM Checkout Resistor across terminals S_O and +.	
	Put 620 ohm resistor across S_R and +.	
	Set minimum position, DCV setpoint, and Exhaust potentiometers fully CCW.	
	Turn DCV maximum position potentiometer fully CW.	
	Set enthalpy potentiometer to D.	
	W7214 *only*: Jumper TR to O.	
	Apply power (24 Vac) to terminals TR and TR1.	
2.	DIFFERENTIAL ENTHALPY	
	Execute step one, Checkout Preparation.	—
	Place 620 ohm resistor across S_O and +.	—
	Place 1.2K ohm resistor across S_R and +.	Free cool LED turns on.

When the first line of a procedure states: “Execute step one. Checkout Preparation.” this directs you to reset the logic module to the initial checkout mode before proceeding.

Checkout W7212



To checkout the operation of the W7212, W7213 or W7214:

1. Remove the MAT or DAT sensor from T-T1.
2. Remove the jumper from P-P1 and place it on T-T1.
3. Remove the OAT and RAT sensors from SO and SO+ and SR and SR+.
4. Place a 620 ohm resistor across SO and SO+ and a 620 ohm resistor across SR and SR+.
5. Connect the actuator to the + and -.
6. Provide 24 Vac to TR and TR1
7. Provide 24 Vac hot to terminal 1.
8. The motor will drive open.
9. Remove the 24 Vac from TR and TR1 and the motor should drive close.

If using a Honeywell DCA, the + on the logic module will be connected to 3 and does not need to be connected to – since the actuators are internally connected to ground.

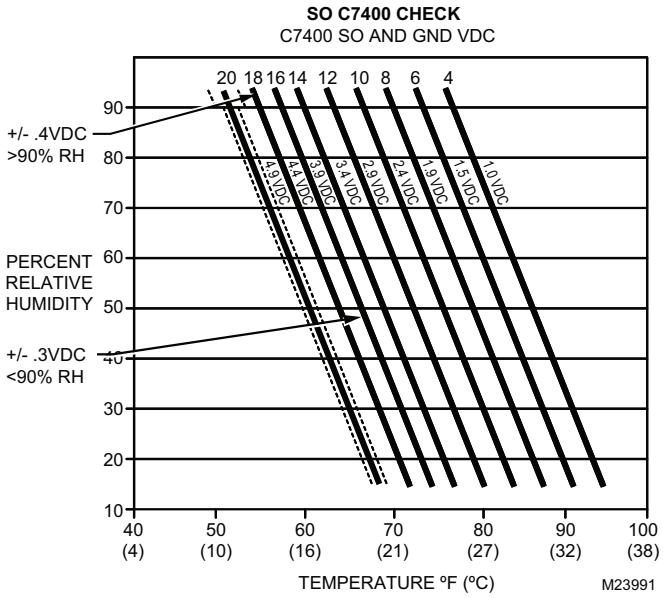
If using two transformers make sure the transformers are tied to the same COM and are from the same power source.

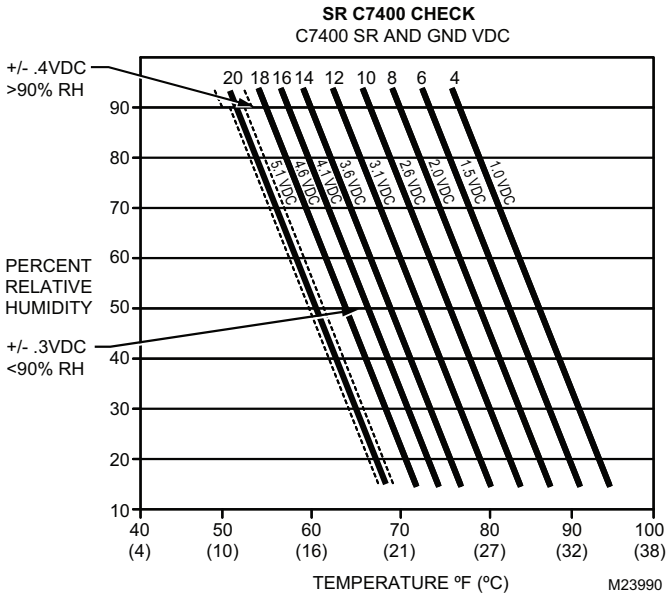
Check out C7400 with W7459, W7210 and W7212:

You can check if the C7400 is within the RH and temperature range with the W7459, W7210 or W7212 logic modules by the following method.

- Make sure the sensors are all connected to the logic module.
- To check the return air C7400 sensor on Sr and Sr+: Measure the voltage across Sr and Ground.
- To check the outdoor air C7400 sensor on So and So+: Measure the voltage across So and Ground.
- You must have an accurate reading of the temperature and humidity.
- Find the line on the chart on this slide for return air C7400 sensor that corresponds to the voltage you read across Sr and ground. It should intersect with the humidity and temperature of your conditions.
- There is a ± 0.3 Vdc range for the sensor accuracy and above 90% RH the accuracy changes to ± 0.4Vdc.

The lines and chart for the So C7400 sensor are slightly different. The reason is for a differential of the sensor inputs to the logic modules for a choice between the two sensors for differential enthalpy. To assure accuracy in reading these charts, which are small, a table is provided on the following page for ease of use.



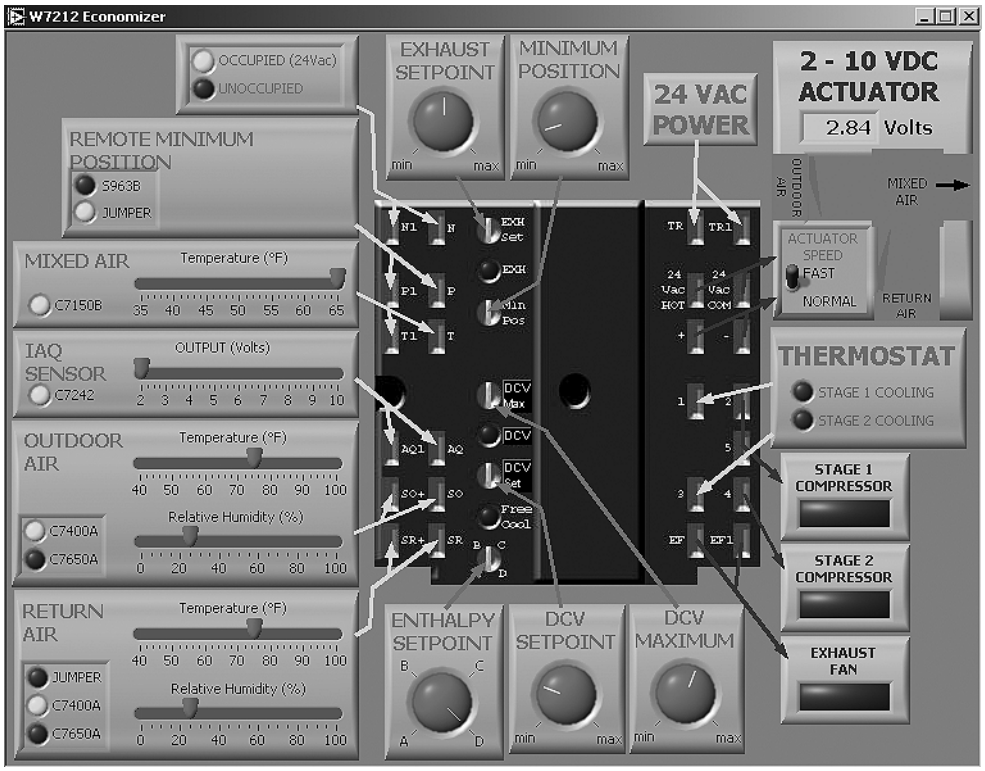


S_O	Vdc measured between SO and GND								
<90% RH									
mA curve	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
Low (-.3 Vdc)	0.672	1.158	1.644	2.13	2.616	3.102	3.588	4.074	4.56
Nominal	0.972	1.458	1.944	2.43	2.916	3.402	3.888	4.374	4.86
High (+.3 Vdc)	1.272	1.758	2.244	2.73	3.216	3.702	4.188	4.674	5.16
> 90% RH									
mA curve	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
Low (-.4 Vdc)	0.572	1.058	1.544	2.03	2.516	3.002	3.488	3.974	4.46
Nominal	0.972	1.458	1.944	2.43	2.916	3.402	3.888	4.374	4.86
High (+.4 Vdc)	1.372	1.858	2.344	2.83	3.316	3.802	4.288	4.774	5.26

S_R	Vdc measured between Sr and GND								
<90% RH									
mA curve	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
Low (-.3 Vdc)	0.72	1.23	1.74	2.25	2.76	3.27	3.78	4.29	4.8
Nominal	1.02	1.53	2.04	2.55	3.06	3.57	4.08	4.59	5.1
High (+.3 Vdc)	1.32	1.83	2.34	2.85	3.36	3.87	4.38	4.89	5.4
> 90% RH									
mA curve	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
Low (-.4 Vdc)	0.62	1.13	1.64	2.15	2.66	3.17	3.68	4.19	4.7
Nominal	1.02	1.53	2.04	2.55	3.06	3.57	4.08	4.59	5.1
High (+.4 Vdc)	1.42	1.93	2.44	2.95	3.46	3.97	4.48	4.99	5.5

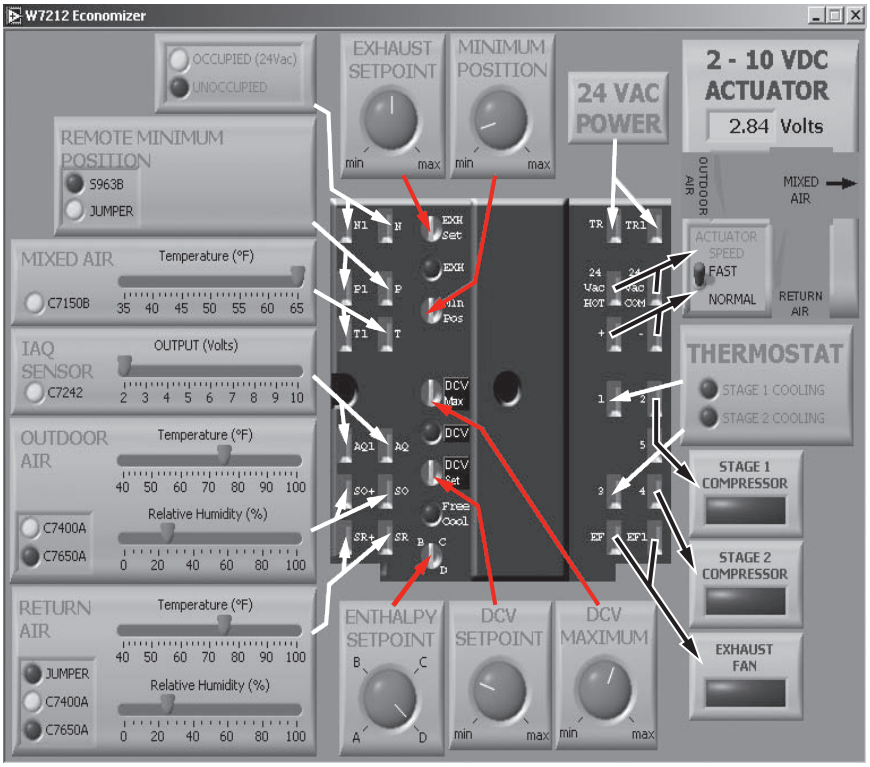
NOTE: The accuracy of the sensors used to measure the temperature and humidity of the environment needs to be considered. If you are close to the measurements your C7400 sensor is probably working.

Section 12 - Simulator for W7212



Honeywell created a simulator to help teach users how the product functions. The program is a 10.5 MB file that can be easily loaded onto your computer desk top. In addition there is a power point presentation that can also be downloaded from the same web page to guide you on how to use the simulator.

On the picture shown below all of the white arrows are inputs to the economizer logic from sensors or a commercial thermostat. All of the red arrows denote changes (potentiometers) or settings that can be made by the user. And the black arrows are out puts of the logic module to the actuator to change the damper position or to the stages of mechanical cooling equipment and exhaust fan.

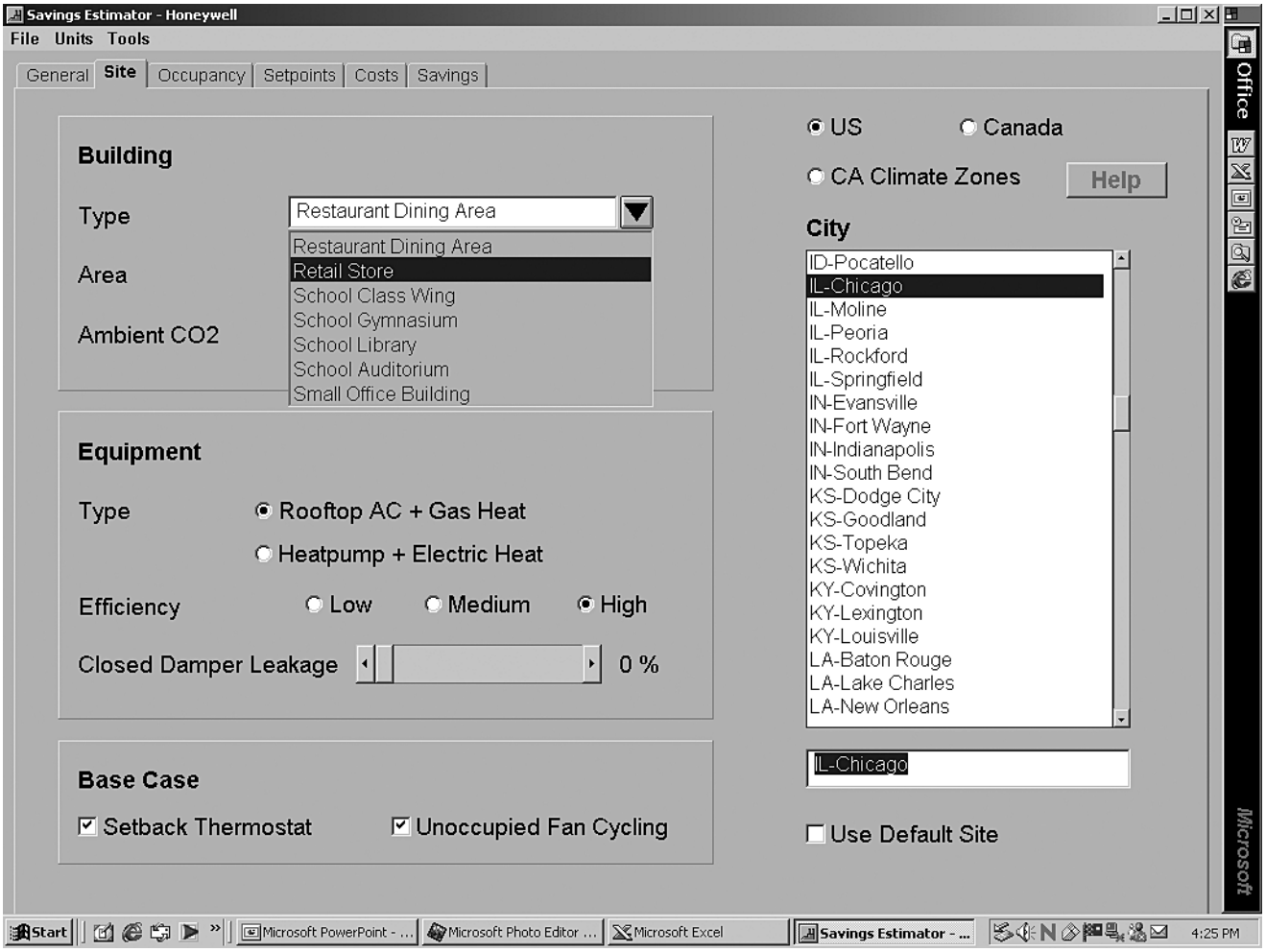


M23992

To download the program:

Go to http://customer.honeywell.com. From the home page, select Applications and Downloads from the drop down menu under the PRODUCTS tab. Or you can click on the PRODUCTS tab, and then click on APPLICATIONS and DOWNLOADS in the second row of tabs. Once you are on this page, scroll down to the Economizer logic module picture and heading. Click on the picture or “View Details” to go to the download page. Follow the instruction on the web page to download the desired file.

Section 13 – Economizer Savings Estimator



Honeywell has an easy to use savings estimation software that was designed by independent consulting Energy Engineers. The software allows the user to input information about the equipment on a building, type of control, occupancy schedule, cost of adding various economizer and DCV options and demand and electrical charges. With the simple click of the mouse, the software will print an estimation of the electrical and gas usage in the building and will estimate the savings and payback for the upgrade options the user has chosen.

You can choose the default settings for a building type or set your own occupancy schedule and control set points for the buildings.

To download the program:

Go to http://customer.honeywell.com. From the home page, select Applications and Downloads from the drop down menu under the PRODUCTS tab. Or you can click on the PRODUCTS tab, and then click on APPLICATIONS and DOWNLOADS in the second row of tabs. Once you are on this page, scroll down to the Economizer logic module picture and heading. Click on the picture or “View Details” to go to the download page. Follow the instruction on the web page to download the desired file.

You can choose to download all weather files for the US, Canada and California climate zones or just the files you need for your region.

The savings is based on 100 years of weather data from 1900 to 2000.

Make sure you update the cost of electricity and demand charges in your region. The current software and estimations are based on 2000 energy costs.

The savings estimator evaluates the operating costs, cost savings, and payback period associated with alternate control strategies or a limited number of prototypical buildings. The program performs hourly calculations with fairly detail models of the building and equipment in order to determine the gas energy, electrical energy, and electrical demand costs. This program is not useful as an energy audit tool for a specific building. However, it does allow the user to study the impact of the following variables:

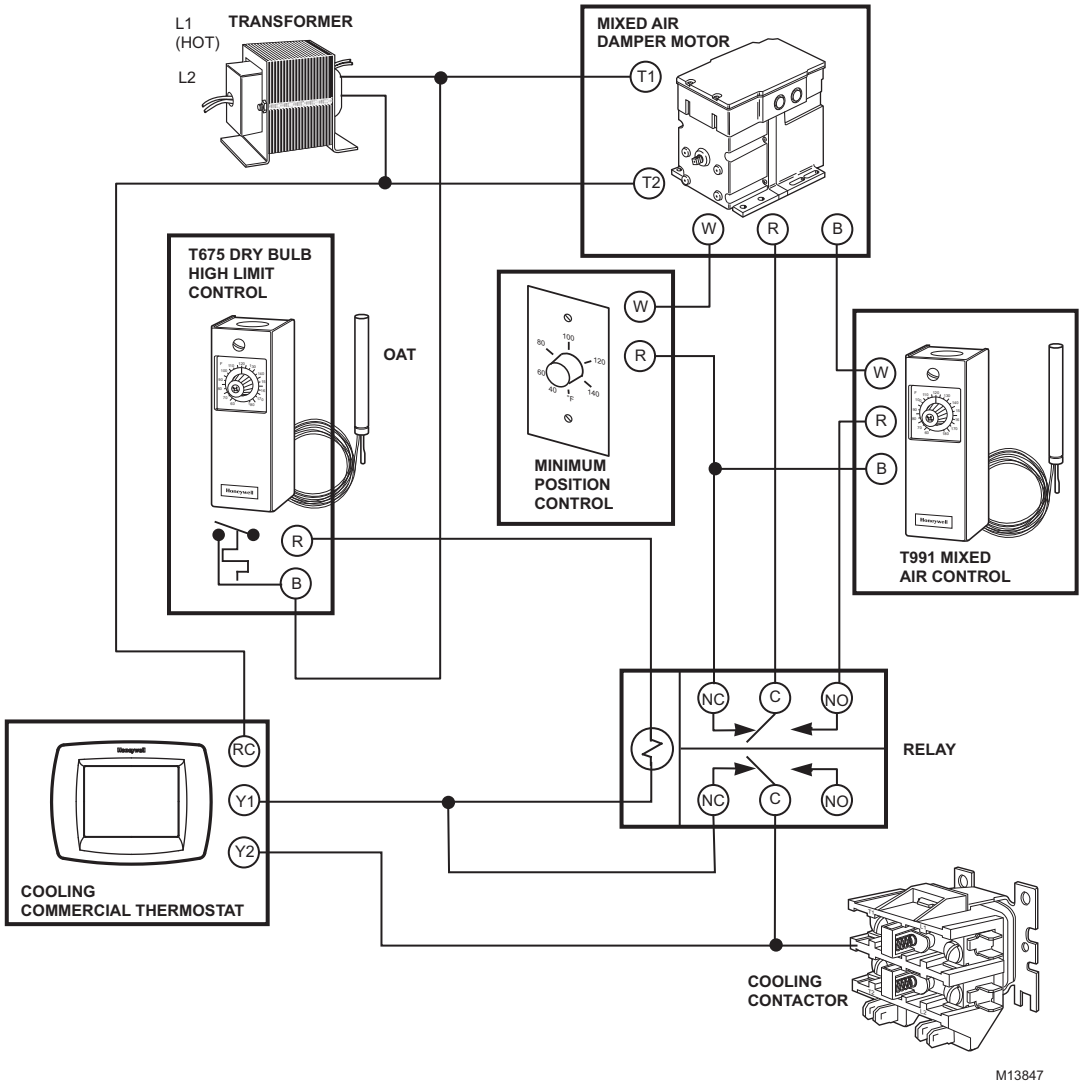
- Climate
- Building size
- Occupancy schedule
- Utility rates
- Equipment type and efficiency
- Cost of controls

The actual costs form this program could differ significantly from those for a particular building due to differences in building specifications, equipment characterizes, specific yearly weather conditions, actual occupancy, etc. However, it is expected that the percentage cost savings associated with the alternative control strategies would be similar for similar building types.

For more detailed description of the data used to calculate the cost savings, click on the “Tools” tab at the top of the first screen of the Estimator and choose “Help”

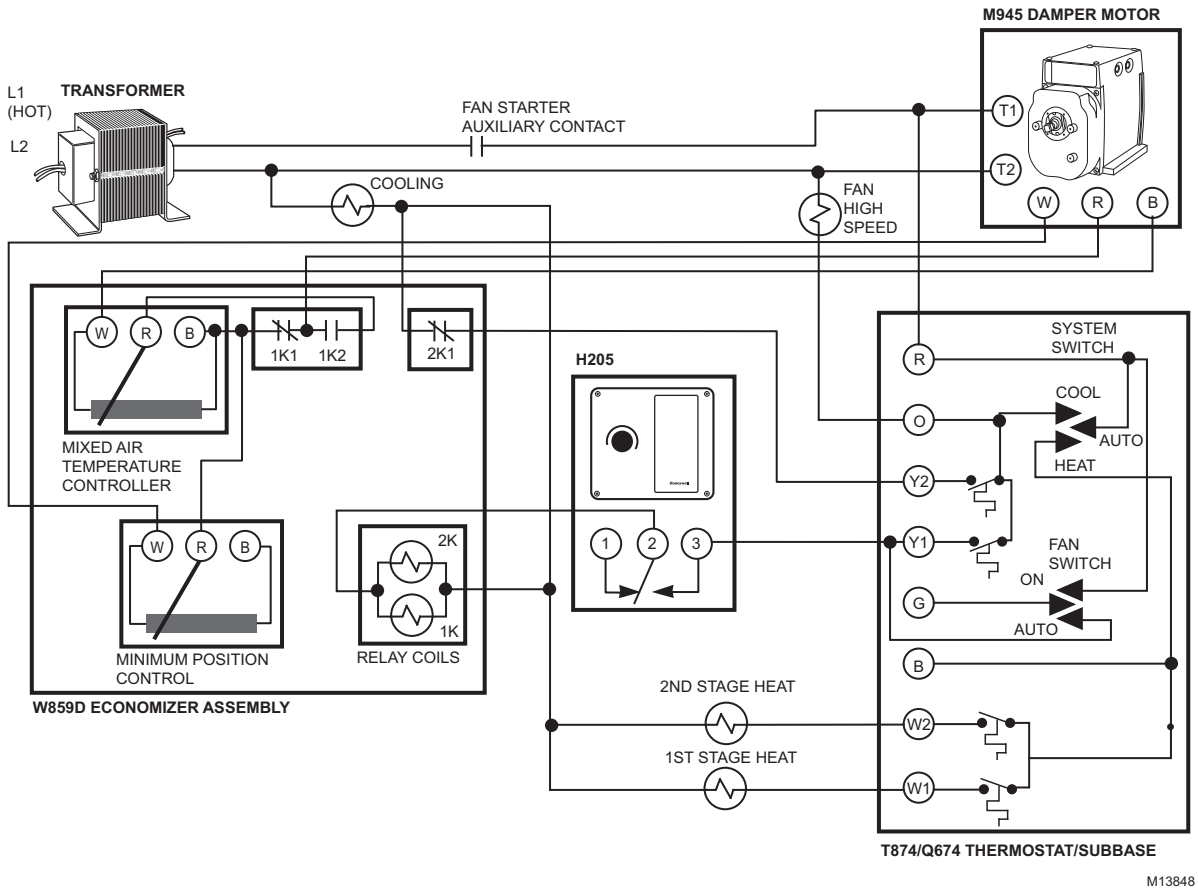
Section 14 - Retrofit and Upgrades

From	Upgrade to
Honeywell T7100, T7300, T7350, T7400 or competitive commercial or residential thermostats	Honeywell TB7220 or TB8220 commercial thermostats
Economizer control systems without integration of the first stage of cooling from the commercial thermostat. Economizer controls such as the W859 with temperature based remote bulb controllers as the changeover devices. Economizer control systems with an electromechanical enthalpy based control such as the H205 as the changeover device.	**Solid State Economizer Controller** H705, W7212 or W7215 Economizer Logic module Two C7400 enthalpy sensors. Choice of one C7150 mixed air or one C7046 supply air sensor New motor/actuator to provide modulating control if replacement is needed. Optional C7232 or C7632 carbon dioxide sensor for demand control ventilation to maximize heating and cooling season energy cost savings.
Economizer control systems with single sensor enthalpy such as H705 or W7459.	Add second C7400 enthalpy sensor for differential enthalpy control and increased energy cost savings.
Economizer control systems without demand control of ventilation (DCV) or indoor air content sensors such as H705, W7459, or W6210 and W7210. Variable air volume air handlers without occupancy based demand control ventilation.	**Enhances Economizer Controller** W7212 or W7215 economizers module Two C7400 enthalpy sensors. Choice is one C7150 mixed air or one C7046 supply air sensor. New motor/actuator to provide modulating control if replacement is needed. C7232 or C7632 carbon dioxide sensor for demand control ventilation to maximize heating and cooling season energy cost savings.



Before: Series 90 with Dry Bulb Changeover

Series 90 was widely used for fifty years as the primary form of electronic temperature control. Due to the durability of these devices there are many of them still in use on rooftop air handlers throughout the world. This is a typical configuration for a dry bulb economizer. The high limit is typically set at 70 or 75°F (21 or 24°C). A relay is used to switch the mixed air control circuit as the first stage of cooling to a minimum position when the outside air minimum position potentiometer provides ventilation by preventing full closure of the outside air dampers.

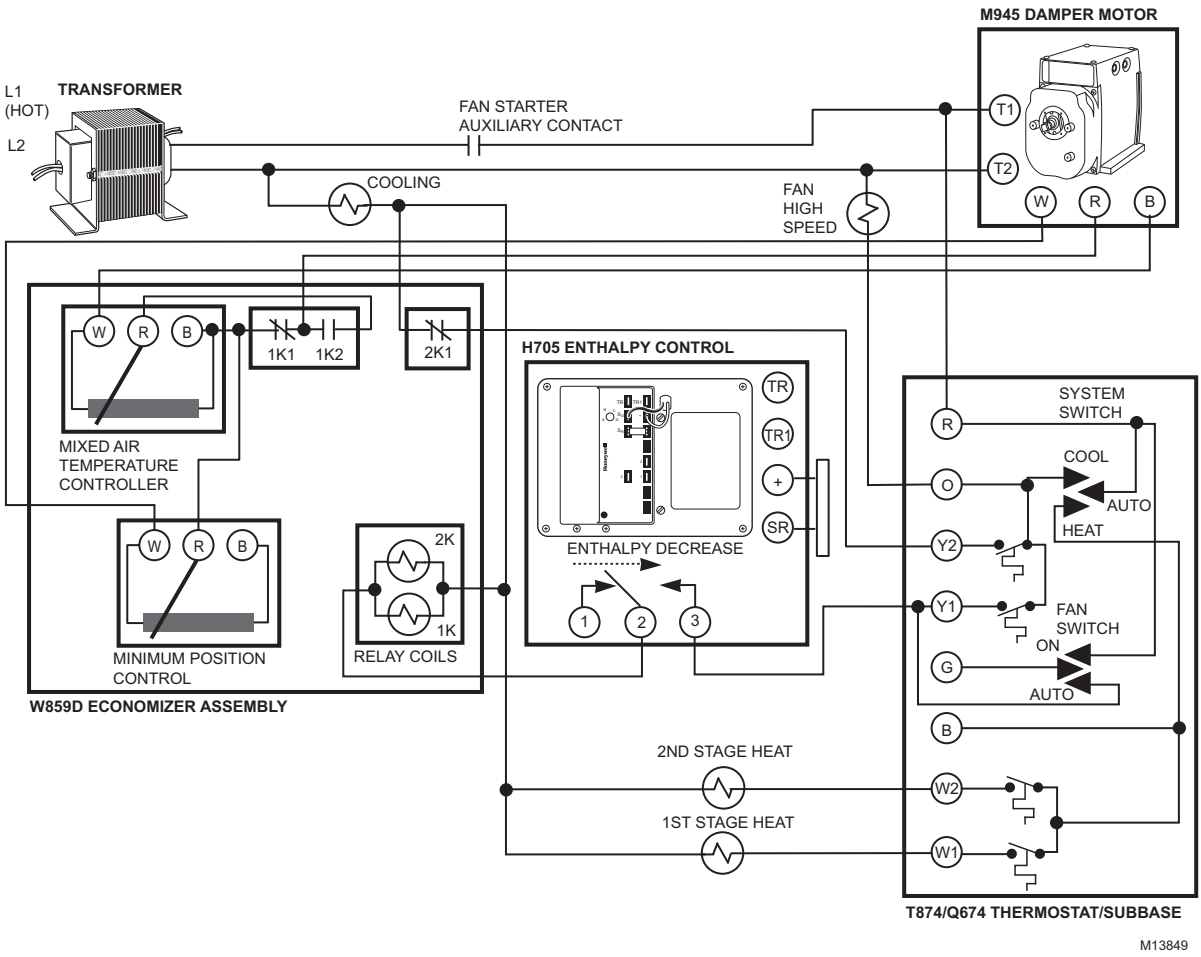


Before: W859 Economizer With H205

The W859 is a combination of multiple control devices that is designed to be installed directly on top of a Mod III or IV Honeywell damper actuator. Included is a mixed air controller, transformer, relays for high limit switchover, minimum damper position and connections for a SPST outside air high limit.

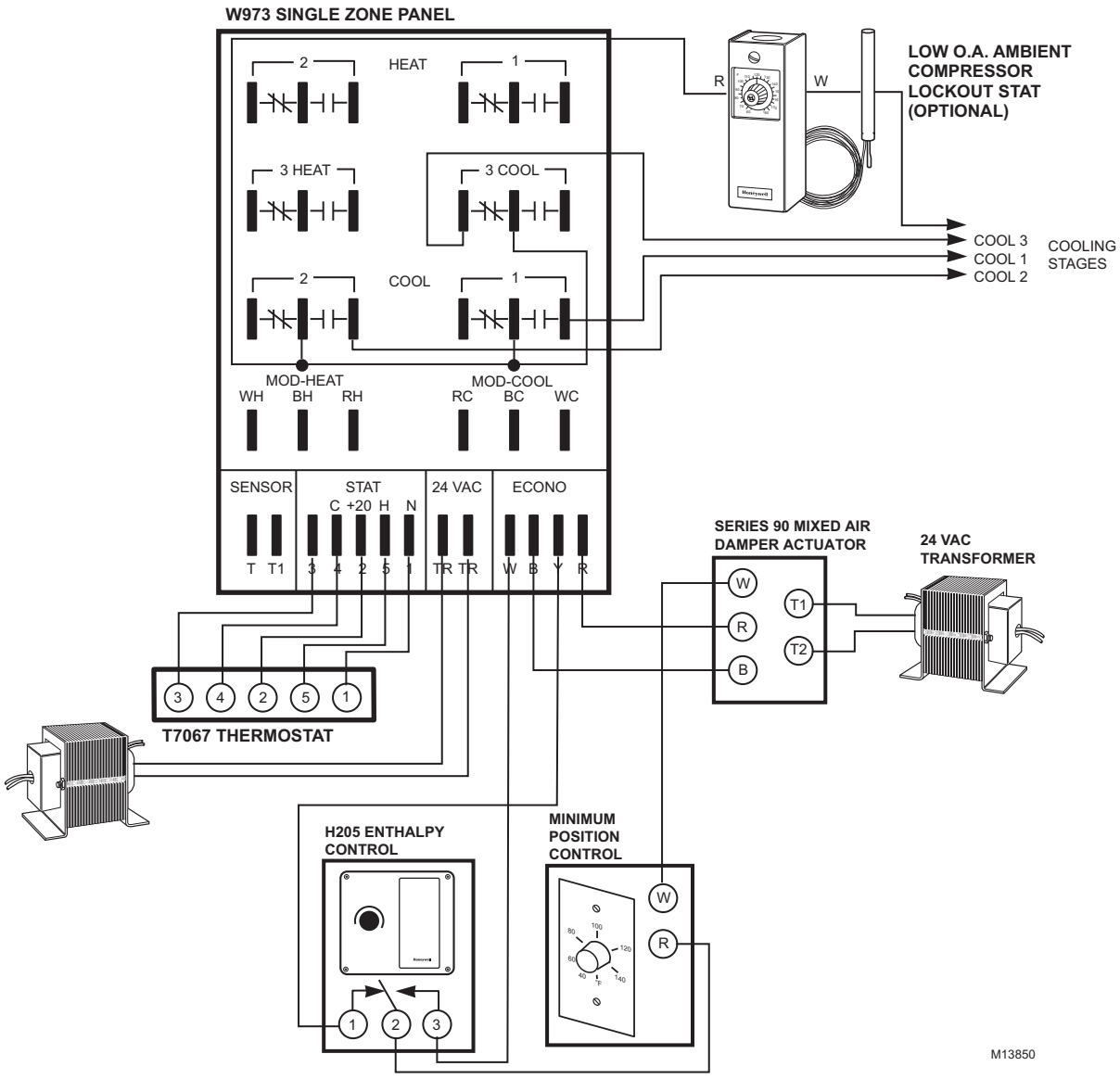
The mixed air controller capillary extends from the case of the W859 to the mixed air section. The setpoint for the mixed air temperature is on the case.

The outside air changeover control is added during installation and can be either dry bulb or enthalpy depending on the application. Many of these were installed on rooftop units with the schematic illustrated above using a H205 enthalpy control as the switchover device. The H205 is an electromechanical enthalpy control with a nylon humidity element.



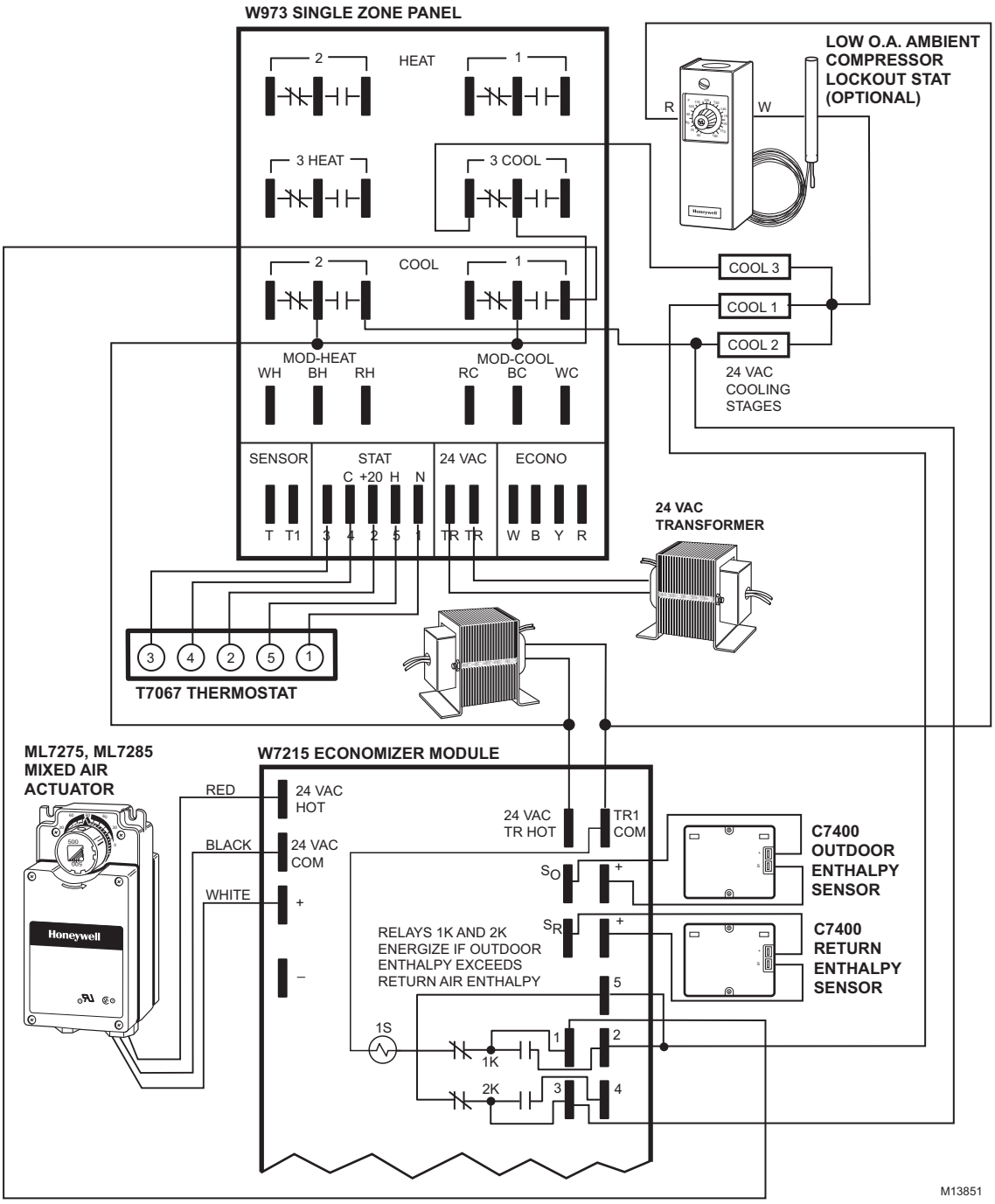
After: W859 with H705

If the actuator is still usable, an H705 control can be installed in place of the T675 or H205. It can be either single sensor or differential enthalpy. The actuator and other wiring can be retained. If the actuator is defective or in need of replacement then refer to the wiring diagrams in this manual for the W7212 or W7215. The selection of an actuator is dependent on the torque requirements. A M7415 motor can be used for low torque and a direct coupled or Mod IV damper actuator for medium or high torque applications.



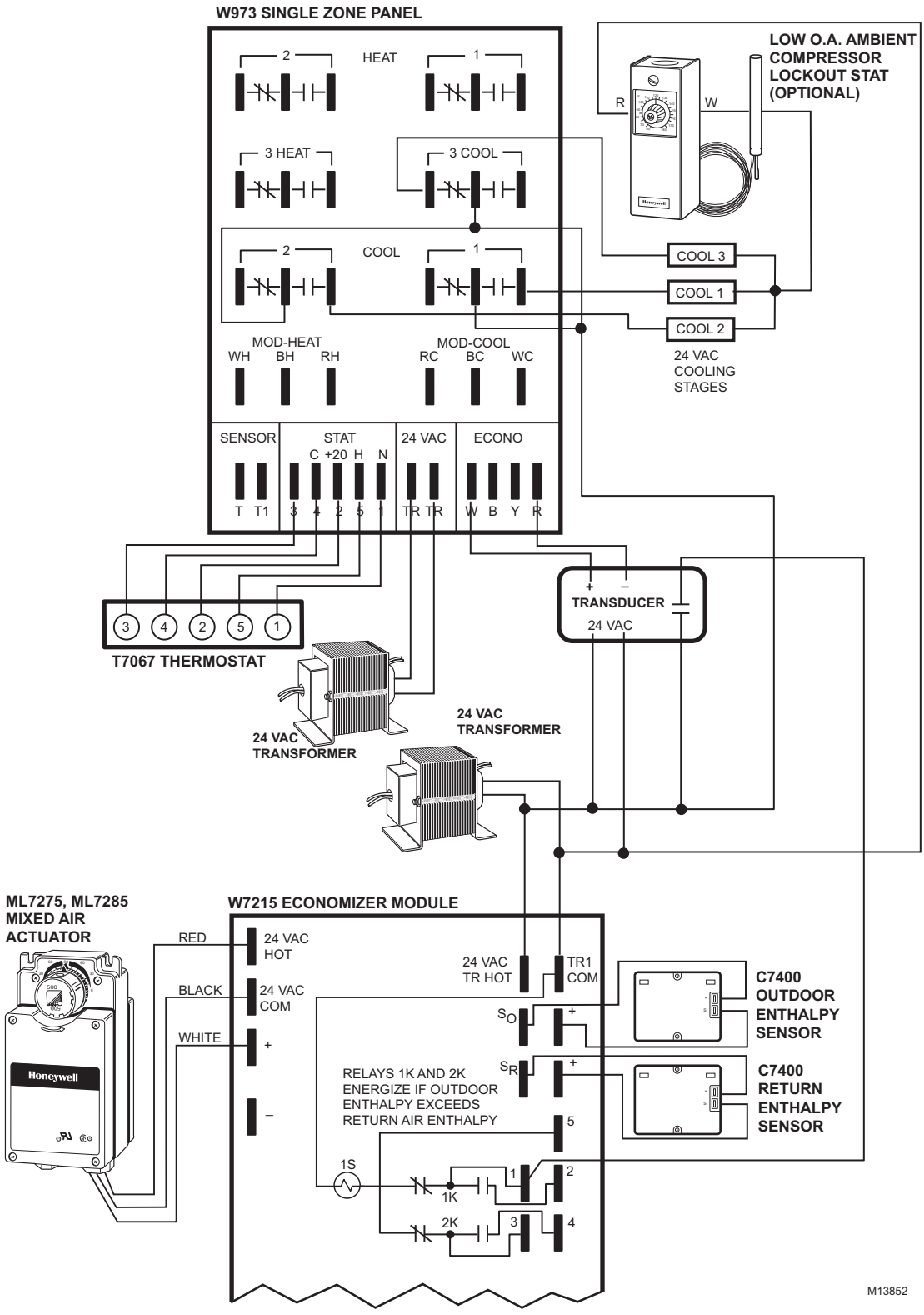
Before: W973 With H205 Control

The W973 is a sequencing panel for Single zone systems that can provide multiple modulating or two-position output stages of control plus a modulating economizer. A dry bulb high limit and a H205 enthalpy control were widely used in the economizer circuit. If they are replaced with a solid state economizer controller, the actuator for the dampers can be retained or replaced. In the replacement illustration on the next page a direct coupled actuator is used.

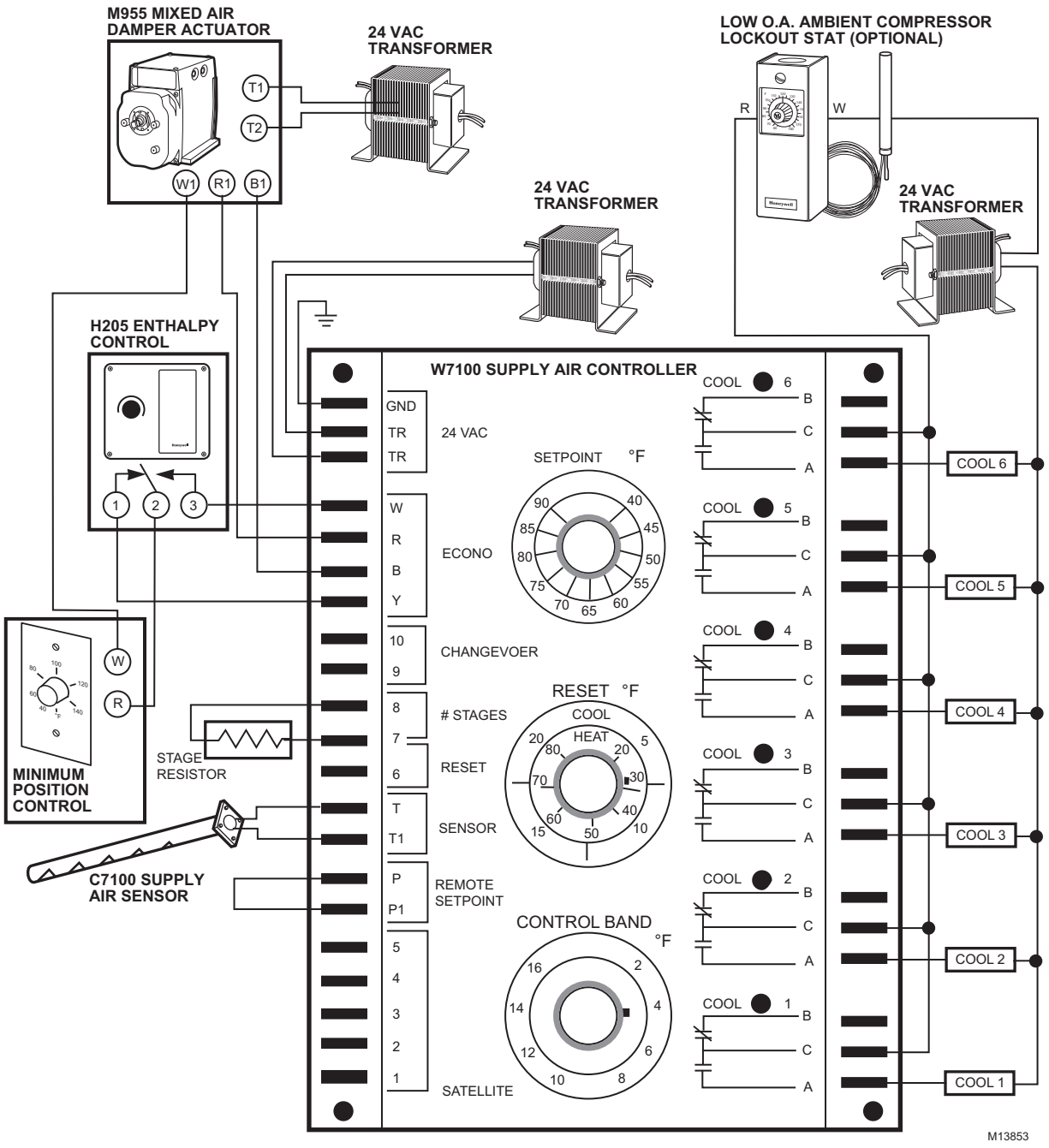


After: W973 with W7215 Economizer Module

Another option used widely in the field was to add a signal transducer on the economizer output of the W973. A signal is sent to a W7212 or W7215 to open the outside dampers if the enthalpy is suitable. The stages of cooling are sequenced through the W973 panel.

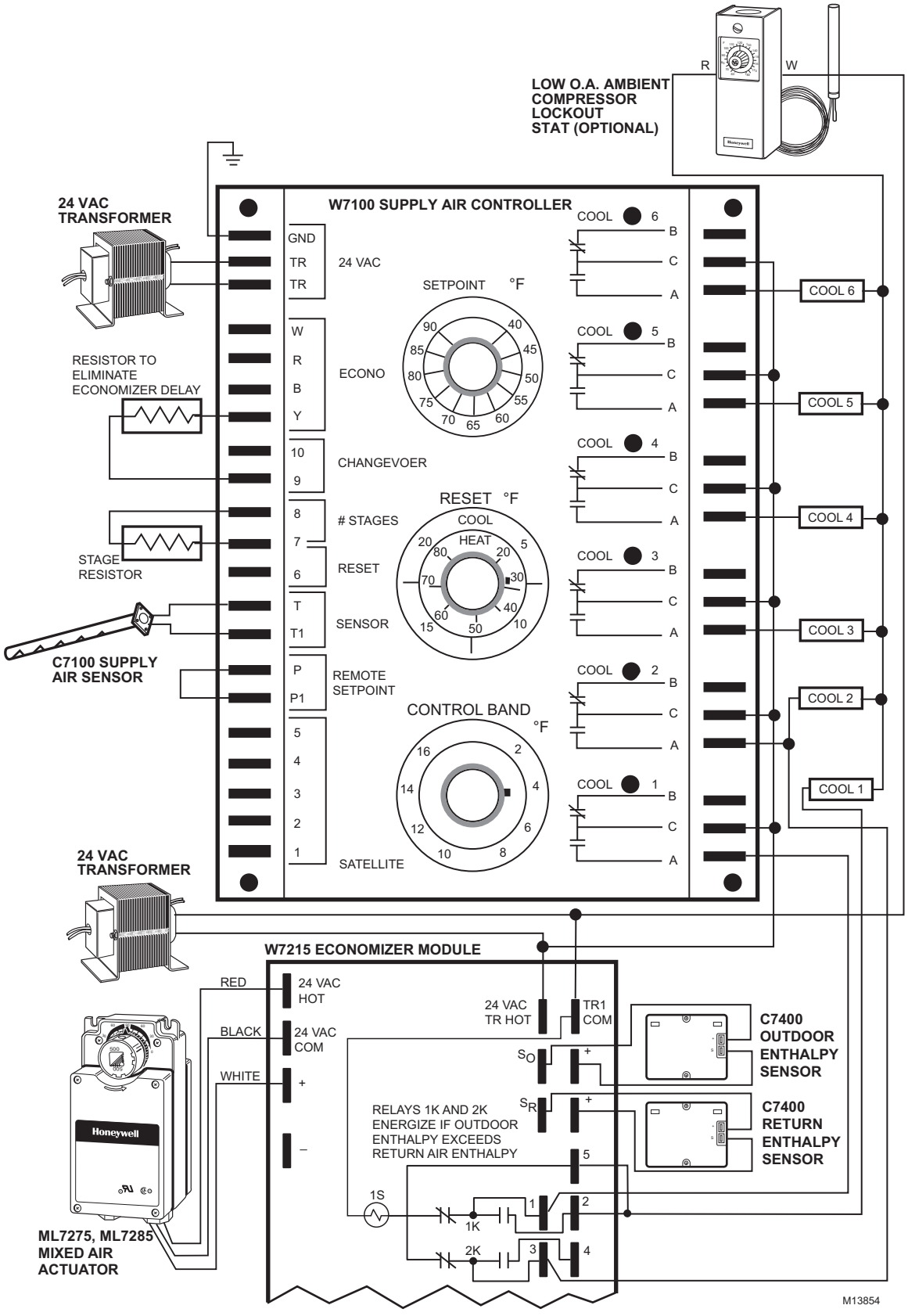


W7215 Module With W973 Panel and Signal Transducer

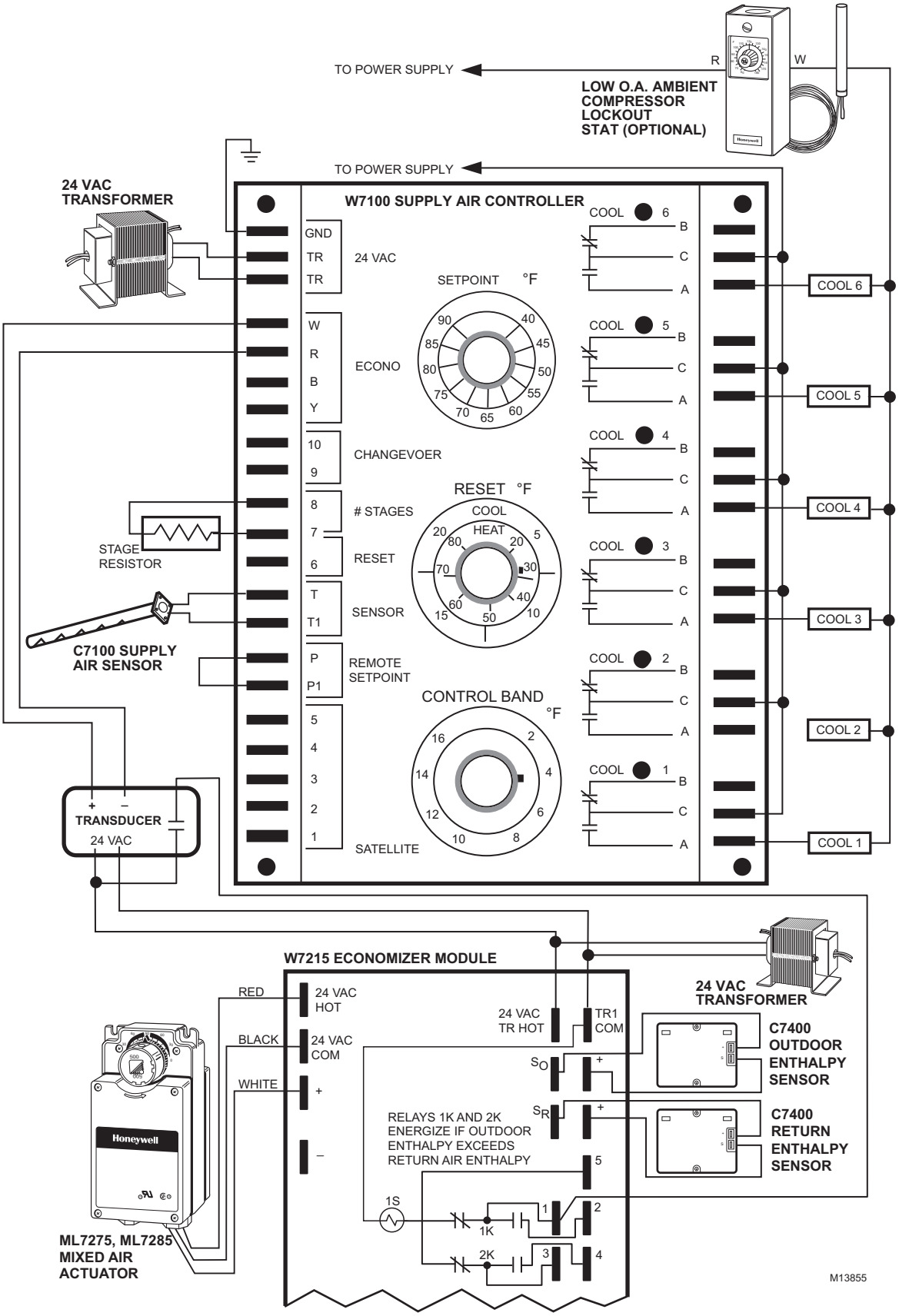


Before: W7100 with H205 Economizer Control

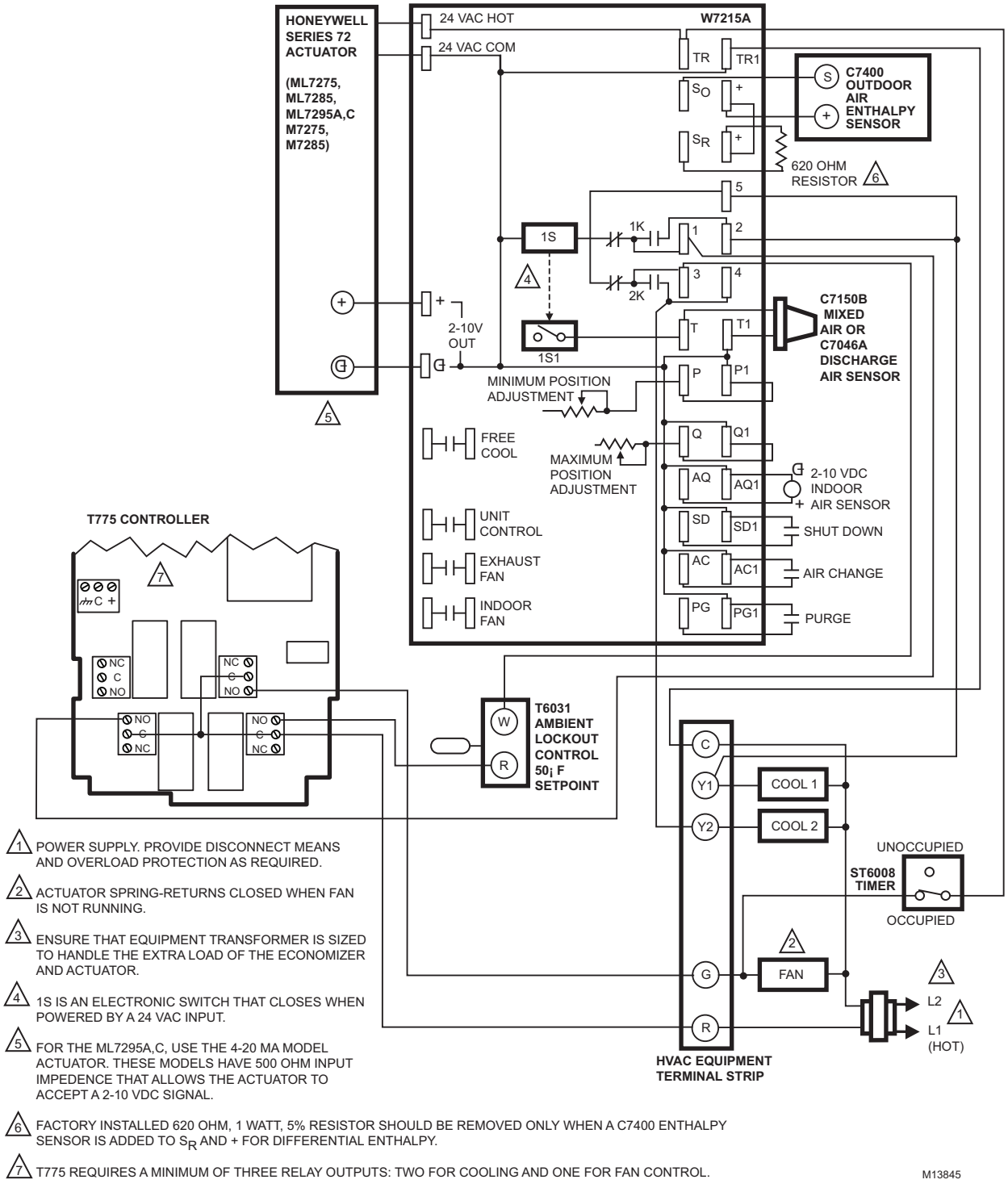
The W7100 is a multiple stage supply air controller available as cooling only, heating only or heating and cooling. Modulating economizer and heat/cool outputs are also provided. The economizer output is sequenced at a setpoint slightly below the cooling stages for maximum efficiency. It is widely used for control of variable air volume air handlers. In this diagram a H205 economizer control is used to return the outside air dampers to minimum when the outdoor enthalpy is high. If a H705 is used the output wiring is identical. On the next page the H205 is replaced with a W7215 enhanced economizer module. You can also replace it with a W7212 economizer module using the wiring shown in the diagram.



W7215 Economizer Module with W7100 Controller



After: W7100 and Signal Transducer with W7215 Module



After: T775 Series 2000 Controller with the W7212 Module

The W7100 or W973 controllers may be replaced with a T775 series 2000 electronic controller directly. The series 2000 has from 1 to 12 output stages depending on the model. See the T775 product literature for details.

How replace an H205 or Barber Colman TH2 Electromechanical Enthalpy control with an H705

Procedure

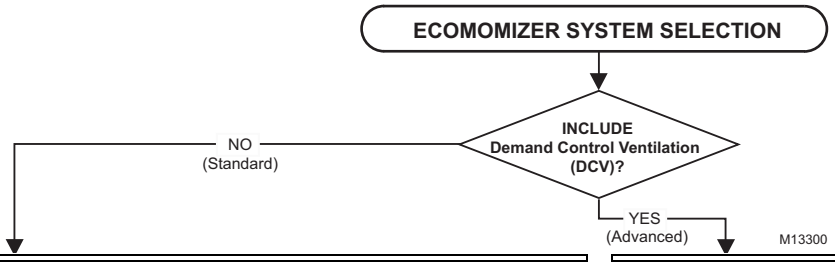
In general, a contractor can replace an electromechanical enthalpy control with an H705 by following these steps:

1. Disconnect power from the HVAC equipment.
2. Remove access panel and locate the electromechanical control.
3. Remove the three wires from the control and label them: yellow is terminal 1 and normally open; red is terminal 2 and common; blue is terminal 3 and normally closed.
4. Remove the electromechanical control.
5. Connect the three wires to the SPDT switch of the H705. The H705 terminal designation matches the H205 and the THC-2. Use 1/4 in. female quick connects to attach the three wires to the H705.
6. Install the H705 in the same location as the removed H205 or THC-2 if they were case and cover models. If non-case and cover models are being replaced, use the mounting bracket provided with the H705.
7. Install two wires from a 24 Vac power source to the TR and TR1 power terminals of the H705. The H705 draws only 5 VA, so a separate transformer should not be required. Use 1/4 in. female quick connects to attach the two power wires to the H705.

To add differential enthalpy;

8. Locate a C7400 in the return air duct and attach to duct work with sheet metal screws.
9. Connect two wires from the C7400 terminals SR and + to the terminals SR and + of the H705. Use 1/4 in. female quick connect to attach the wires to the H705 and C7400.
10. Re-apply power to the HVAC unit.
11. Reset or re-check the minimum position and ventilation to make sure it meets code and the ventilation required for the space.

Economizer Systems Quick Selection Guide



Motor Type	Motor	Logic Module	Sensors
Foot Mount 25 lb-in. Torque	M7415	W7459A,D	Enthalpy: C7400[a] with C7150 Temperature: C7650 with C7150
	M9175	H705 or W7210[b]	
DCA 44 lb-in. Torque	MS7505	W7210	
Foot Mount 60 lb-in. Torque	M7285 M7286	W7210	
	M9185 M9186	H705, W7210[b]	
DCA 88 lb-in. Torque	MS7510	W7210	
DCA 175 lb-in. Torque	MS7520	W7210	

Motor Type	Motor	Logic Module	Sensors
Foot Mount 25 lb-in. Torque	M7415	W7460	Enthalpy: C7400[a] with C7150 Temperature: C7650 with C7150 CO_2: C7232 or C7632
	M7215	W7212/13/14	
	M9175	W7215[b], W7212[b], W7213/14	
DCA 44 lb-in. Torque	MS7505	W7215	
Foot Mount 60 lb-in. Torque	M7285 M7286	W7215, W7212, W7213/14	
	M9185 M9186	W7215, W7212[b], W7213/14[b]	
DCA 88 lb-in. Torque	MS7510	W7215, W7212, W7213/14	
DCA 175 lb-in. Torque	MS7520	W7215, W7212, W7213/14	

[a] Enthalpy sensor. Use two for differential enthalpy and one for single enthalpy. For Dry Bulb only, use C7650 instead.

[b] To operate a Series 90 motor, the W7210 and W7215 require a Q7230 interface module or the proper resistor combination (included in the 4074EJM resistor kit), see form 63-2544 for details.

NOTE: Series 90 Mod Motors™ can be retrofit using W7210, W7212 or W7215 Economizer Logic Modules and a Q7230 or the proper resistor combination. Refer to form 63-2544 for details on using Economizer Logic Modules with Series 90 motors.

Logic Module Details

Model	ISI	OSI	Enthalpy High Limit	Exhaust Fan Setpoint	Shutdown and Air Change	Purge	Motors Controlled	OS Number
Standard								
H705[a]	No	No	None	None	No	No	Series 90	H705A1003
W749	No	No	No	None	No	No	M7415	W7459A1001
			Yes					W7459D1005
W7210	No	No	No	None	No		Series 72	W7210A1001
			Yes					W7210D1005
Advanced								
W7212	Yes	No	No		Yes	No	Series 72	W7212A1009
W7213/14[b]	Yes	No	No		Yes	No	Series 72	W7213A1008[b]
								W7214A1007[b]
W7215	Yes	No	No	Adjustable	Yes	Yes	Series 72	W7215A1006
		Yes		Fixed		No		W7215B1004
W7460	Yes	No	No	Adjustable	Yes	Yes	M7415	W7460A1008
		Yes		Fixed		No		W7460B1006

[a] The H705 includes a SPDT logic module and C7400 sensor (both affixed to the mounting plate).

[b] Terminals B-B1 (W7213) for heat pump applications, terminals 0-01 (W7214) for heat pump applications.

Sensor Details

Model	Sensor of	Details	Comments	OS Number	
				No Display	Display
C7150	Temperature	Discharge or Mixed Air	Thermistor on board	C7150B1004	—
C7400	Enthalpy	Changeover	—	C7400A1004	—
C7650	Dry Bulb Temperature		—	C7650A1001	—
C7232	CO_2	Wall Mount	Outputs: one relay, one 0/2-10 Vdc analog or 4-20 mA	C7232A1016	C7232A1008
		Duct Mount		C7232B1014	C7232B1006
C7632	CO_2	Wall Mount	Outputs: one fixed 0-10 Vdc analog (fixed 0-2000 ppm)	C7632A1004	—
		Duct Mount		C7632B1002	—

Cross Reference

Any Honeywell economizer can be upgraded to use the latest economizer models with the added options of Demand Control Ventilation, exhaust fan set point, purge, air change, outdoor air quality, or system shutdown. See below for cross reference and upgrade options for the economizer modules and sensors.

Sensors

Sensor	Comments	Can be replaced with
C7046A1004	Standard with 8 in probe	
C7046A1012	OEM Carrier	C7046A1004
C7046A1020	OEM York	C7046A1004
C7046A1038	C7046A1038 has 12 inch probe	C7046A1004
C7046A1046	OEM Rheem with 24 inch leads	C7046A1004
C7150B1004	Standard 3k ohm @ 70°F	
C7150B1012		C7150B1004
C7150B1020	OEM Carrier 3750 @ 70°F	C7150B1004
C7150B1038	Standard 3750 @ 70°F	C7150B1004
C7150B1046	Standard 10k @ 70°F	
C7232A1008	Wall with display, 1 relay out with Honeywell logo	C7232A1016
C7232A1016	Wall no display, 1 relay out with Honeywell logo	C7232A1008
C7232A1024	Wall with display, 1 relay out, no Honeywell logo	C7232A1008
C7232A1032	Wall no display, 1 relay out, no Honeywell logo	C7232A1016
C7232A1057	Wall with display, 1 relay out, Honeywell logo, 220 Vac, on-off	none
C7232B1006	Duct with display, 1 relay and 1 analog out with Honeywell logo	C7232B1014
C7232B1014	Wall no display, 1 relay and 1 analog out	C7232A1008
C7232B1022	Duct with display, 1 relay and 1 analog out, no Honeywell logo	C7232B1006
C7232B1030	Duct no display, 1 relay and 1 analog out, no Honeywell logo	C7232B1014
C7242A1006	Wall with display, 1 relay and 1 analog out	C7232A1016
C7242A1014	Wall with display, 1 relay and 1 analog out	C7232A1016
C7242A1022	Wall no display, 1 relay and 1 analog out	C7232A1008
C7242A1022	Wall no display, 1 relay and 1 analog out	C7232A1008
C7242A1030	Wall with display, 1 relay and 1 analog out	C7232A1016
C7242A1048	Wall no display, 1 relay and 1 analog out	C7232A1008
C7242B1004	Wall no display, 1 relay and 1 analog out	C7232A1008
C7242B1012	Duct with display, 1 relay and 1 analog out	C7232B1006
C7242B1020	Wall no display, 1 relay and 1 analog out	C7232A1008
C7242C1002	Portable with display, 1 analog out	
C7242D1000	Wall with display, Echelon model	none
C7242D1018	Duct with display, Echelon model	C7242D1000
C7242E1007	Outdoor no display, 1 analog out	none
C7400A1004	Standard	
C7400A1012	OEM York	C7400A1004
C7400A1020	Use with H705	C7400A1004
C7400A1038	OEM Lennox	C7400A1004

Sensor	Comments	Can be replaced with
C7400A1046	OEM Carrier	C7400A1004
C7400A1053	OEM Bard	C7400A1004
C7632A1004	Wall no display, with Honeywell logo, 1 analog out	
C7632B1002	Duct no display, with Honeywell logo, 1 analog out	
C7650A1001	Standard	
C7650A1027	OEM Carrier	C7650A1001

Economizer

Economizer	Comments	Can be replaced with
H205A1004	Standard	H705A1003
H205A1012	With mounting plate, adjustment knob, and scale	H705A1003
H205A1053	OEM Climate Control	H705A1003
H205A1061	OEM Carrier #HH57AC076	H705A1003
H205A1087	OEM Trane #13540687-01	H705A1003
H205A1095	OEM Carrier #HH57AC075	H705A1003
H205A1103	OEM Trol-A-Temp with mounting plate, adjustment knob, and scale	H705A1003
H705A1003	Standard	
H705A1011	OEM York #025-27491	H705A1003
H705A1029	OEM Carrier #HH57AC077	H705A1003
W6210A1003	Standard	
W6210D1007	High enthalpy limit model	
W6215A1008	Standard	
W7210A1001	Standard	W7212A1009
W7210D1005	High enthalpy limit model	W7212A1009
W7210D1013	OEM York #10165	
W7212A1009	Standard	
W7212A1017	OEM Carrier #HH63AW001	W7212A1009
W7212A1025	OEM York #10208 Do not replace with W7212A1009	
W7212A1033	OEM Lennox #60M1001	W7212A1009
W7215A1006	Standard	
W7215A1014	OEM Carrier	W7215A1006
W7215B1002	OEM Trane #X13610221-01	M7415B1020 + Q709A1005
W7215B1004	With outdoor IAQ	
W7299A1005	OEM York #65997 W7212A1025 + M7215A1024 + 4074EGR Do not replace with standard model.	
W7299A1013	Standard W7212A1009 + M7215A1008 +4074EGR + 32001401-017	

Economizer	Comments	Can be replaced with
W7340A1004	OEM Trane Standard	W7340C1000
W7340A1012	With wire harness	W7340C1000
W7340A1020		W7340C1000
W7340B1002	OEM Trane #X1365108202	W7340C1000
W7340C1000	OEM Trane Standard #X1365108203	
W7345A1009	OEM Trane	W7345B1001
W7345B1001	OEM Trane Standard W7340A1004 + M7215A1016	
W7399A1004		W7399C1010
W7399B1002		W7399C1010
W7399C1010	OEM Standard W7340C1000 + M7215A1016	
W7415A1004	OEM Trane #X13610221-02	M7415A1063 + Q709A1013
W7459A1001	Standard	
W7459A1019	OEM York #3597 Do not replace with W7459A1001	
W7459A1027	OEM Lennox #54G4301	W7459A1001
W7459A1035	OEM limits minimum position to 50% open and allows operation with temp activated switch	
W7459A1050	OEM Bard #8602-053	W7459A1001
W7459B1009	Use with M7405 and W7401	
W7459C1007	Use with M8405	
W7459D1005	High enthalpy limit model	W7459A1001
W7460A1008	Standard	W7212A1009 + Q769C1000
W7460B1006	With outdoor IAQ	
W7499A1003	Standard M7415A1006 + W7459A1001	
W7499A1011	OEM York M7415A1014 + W7459A1019 Do not replace with standard models.	
W7499A1029	OEM Trane #1361023001 M7415A1006 + W7459A1035	
W7499A1037	OEM Trane #X12650879-01 M7415A1089 + W7459A1036	
W7499B1001	OEM Carrier #HF25CA003. M7415B1004 + W7459A1001	
W859A1000	Check voltage, original economizer was 120 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1005 + 203977A
W859A1034	203977A required for Mod IV application only.	W859F1005 + 203977A

Economizer	Comments	Can be replaced with
W859A1042	Check voltage, original economizer was 120/208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1005 + 203977A
W859B1017	203977A required for Mod IV application only.	W859F1005 + 203977A
W859C1040	Check voltage, original economizer was 120/208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1005 + 203977A
W859C1057	Check voltage, original economizer was 120/208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1005 + 203977A
W859D1015	Check voltage, original economizer was 120/208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1013 + 203977A
W859D1023	Check voltage, original economizer was 208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1021 + 203977A
W859D1031	Original economizer had 76 inch averaging element Replacement has 144 inch averaging element. 203977A required for Mod IV applications only.	W859F1013 + 203977A
W859D1049	Check voltage, original economizer was 120/208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1021 + 203977A
W859D1064	203977A required for Mod IV application only.	W859F1013 + 203977A
W864D1007	203977A required for Mod IV application only.	W859F1021 + 203977A
W864D1023	203977A required for Mod IV application only.	W859F1021 + 203977A
W864D1031	Check voltage, original economizer was 208/240 Vac. If required use 198162EA in Mod IV Motor. 203977A required for Mod IV application only.	W859F1021 + 203977A
W899A1006	M9164D1009 (with stroke set to 160) +198162EA may be substituted for M9164A1013.	W859F1005 + M9164A1013 + 203977A adaptor
W899A1030	M9164D1009 (with stroke set to 160) may be substituted for M9164A1013.	W859F1005 + M9164A1013 + 203977A adaptor

Economizer	Comments	Can be replaced with
W899A1089		W859F1005 + M9164D1009 (with stroke set to 90) + 203977A adaptor
W899E1028	M9164D1009 (with stroke set to 160) may be substituted for M9164A1070.	W859F1013 + M9164A1070 + 203977A adaptor
W899E1036	OEM Singer M9164D1009 (with stroke set to 160) +198162EA may be substituted for M9164A1013.	W859F1021 + M9164A1013 + 203977A adaptor
W899E1051	M9164D1009 (with stroke set to 160) may be substituted for M9164A1070.	W859F1021 + M9164A1070 +198162AA transformer + 203977A adaptor
W899E1085	M9164D1009 (with stroke set to 160) may be substituted for M9164A1070.	W859F1021 + M9164A1070 +198162AA transformer + 203977A adaptor
W899G1034	M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1013 + M9185A1018 + 203977A adaptor
W899G1042	M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1021 + M9185A1018 +198162AA transformer + 203977A adaptor
W899G1075	OEM Singer #050760 M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1021 + M9185A1018 +198162AA transformer + 203977A adaptor
W957B1019	OEM Trane #13610206-01 M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1021 + M9185A1018 +198162AA transformer + 203977A adaptor
W957C1018	M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1021 + M9185A1018 + 203977A adaptor
W957D1009		W859F1021 + M9185D1004 +198162AA transformer + 203977A adaptor
W957E1016		W859F1021 + M9185D1004 +198162AA transformer + 203977A adaptor
W957F1007	OEM Carrier #HF25CA002A	W957G1006
Y514A1090		W859F1021 + M9185A1018 +198162AA transformer + 203977A adaptor + H205A1004 + 138823 Knob
Y514A1124	OEM Trane M9185D1004 (with stroke set to 160) may be substituted for M9185A1070	W859F1021 + M9164A1070 +198162AA transformer + 203977A adaptor + H205A1004 + 7616BR Crank arm + 118349 Scale Plate +
Y514A1132	M9185D1004 (with stroke set to 160) may be substituted for M9185A1018.	W859F1021 + M9185A1018 + 203977A adaptor + H205A1012 + 138823 Knob
Y514A1173	OEM Trane	W859F1021 + M9185D1004 +198162AA transformer + 203977A adaptor + H205A1004 + 7616BR Crank Arm + 118349 Scale Plate + 138823 Knob

Commercial Thermostats

Commercial Thermostats	Comments	Can be replaced with
All T7300's with Q7300H	Communicating	T7350H1009
	Modulating	T7350H1017
		T7350M1008
All T7300's with Q7300A2008	Conventional or Heat Pump	T7350A1004
All T7300's with Q7300A and Q3700C	Conventional or Heat Pump	T7350B1002
All T7300's with non-Q7300H	Conventional or Heat Pump	T7350D1008
T7300 with Q7300A2016, Q7300A2008, Q7300C2004 and Q7300C2012	Commercial VisionPRO 8000	TB8220U1003

Appendix

Glossary

Air Content Sensor—A sensor used to measure certain components of the air in a room or other supply source. It is used as an input to adjust control sequences or parameters. Carbon Dioxide (CO_2) is frequently measured as one component of overall air quality to make adjustments to ventilation controllers.

Air Quality Standard—A government mandated regulation which specifies the maximum contaminant concentration beyond which health risks are considered to be unacceptable.

Automatic Control Loop—A set of devices that react to a change or imbalance in the controlled variable by adjusting other variables to restore the desired balance.

Balance Point—The outside air temperature value at which the cooling equipment is turned on. It is used to calculate the savings from an economizer control application.

Building-Related Illness—A diagnosable illness with identifiable symptoms whose cause can be directly attributed to airborne pollutants within a building such as Legionnaires disease or hypersensitivity pneumonitis.

Changeover Control—The control device used to switch over from outside to return air or visa versa to make optimum use of outside air for free cooling.

Controlled Medium—The medium in which the controlled variable exists. In a room temperature control loop, the controlled variable is the space temperature and the controlled medium is the air within the room.

Controlled Variable—The quantity or condition that is measured and controlled.

Differential Enthalpy—The selection of a supply air source for the mixed air based on the lower enthalpy value derived from two enthalpy sensors located in the outside and return air sources.

Most Honeywell electronic enthalpy economizer modules are based on a similar setpoint configuration. The available settings A, B, C and D are for single sensor or high limit enthalpy control. For differential enthalpy the dial is turned to D.

Dilution—The reduction of airborne concentration of contaminants through an increase in outdoor air supplied to the area.

Discharge or Supply Air—Air which has been treated (heated or cooled) before being supplied to the conditioned area or room.

Economizer—Economizer controls provide "free cooling" during the cooling season by measuring the temperature or enthalpy of outside air. Outside air is used for cooling if it is sufficiently cool and dry. This reduces the usage of the mechanical cooling equipment and reduces cooling costs.

Electric Control—A control circuit that operates on line or low voltage and uses a mechanical device, such as a temperature-sensitive bellows, to perform control functions, such as actuating a switch or positioning a potentiometer. The controller signal typically operates or positions an electric actuator or may switch an electrical load directly or through a relay.

Electronic Control—A control circuit that operates on low voltage and uses solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator. The controller typically furnishes fixed control algorithms based on the circuitry inside the solid-state components.

Electromechanical Controller—A control device such as the H205 which is constructed of moving parts instead of solid state or electronic components. Typically more calibration and replacement is required of these devices than solid state controllers.

Enthalpy—A measure of the total energy content of air based upon both temperature and moisture content. When selecting air for cooling it is a better measurement than solely temperature.

Final Control Element—A device such as a valve or damper that is used to change the value of the manipulated variable. Positioned by an actuator.

Indoor Air Quality (IAQ)—The characteristics of the indoor climate of a building, including the gaseous composition, temperature, relative humidity, and airborne contaminants.

Integrated Economizer—An economizer control circuit that replaces the inefficient "wild" economizer by only enabling outside air for cooling when there is a call for cooling from the commercial thermostat.

Manipulated Variable—The quantity or condition regulated by the automatic control equipment to cause the desired change in the controlled variable.

Mixed Air—The combination of outdoor and return air prior to mechanical cooling or heating.

Modulation—A control mode with minute increments and decrements.

Proportional Band—In a modulating controller, the control point range through which the controller output varies through a predefined range (3 to 15 PSI - 21 to 103 kPa, 2 to 10 volts, 1 to 100%). Sometimes expressed in percent of primary sensor span. Commonly used equivalents are "throttling range" and "modulating range", usually expressed in degrees of temperature.

Sensing Element—A device or component that measures the value of a variable such as temperature or humidity.

Setpoint—The value at which the controller is set such as the desired room temperature on a commercial thermostat.

Throttling Range—In a modulation controller, the control point range through which the controlled variable must pass to move the final control element through its full operating range. Expressed in values of the controlled variable such as degrees, percent relative humidity, or pressure in pounds per square inch or kPa. Also referred to as “proportional band”. For a modulating commercial thermostat, the temperature change required to drive the manipulated variable from full off to full on.

Total Heat—Same as enthalpy.

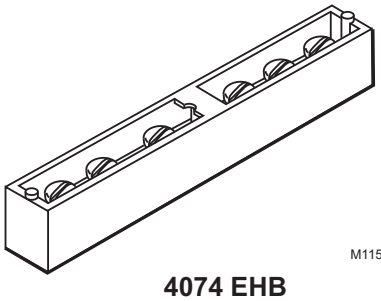
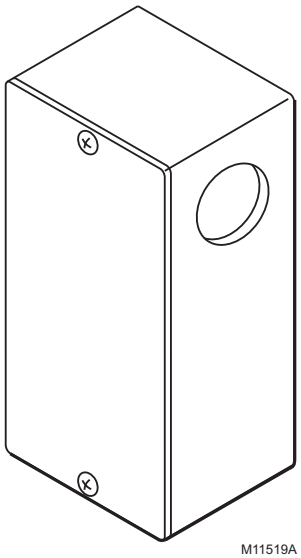
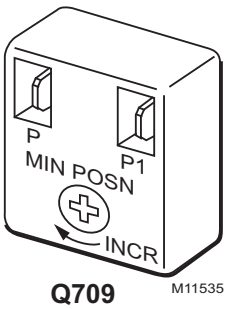
Two-Position—A basic on-off control circuit in which the device being controlled is either full on or full off with no intermediate operating positions available. Also referred to as “on-off” control.

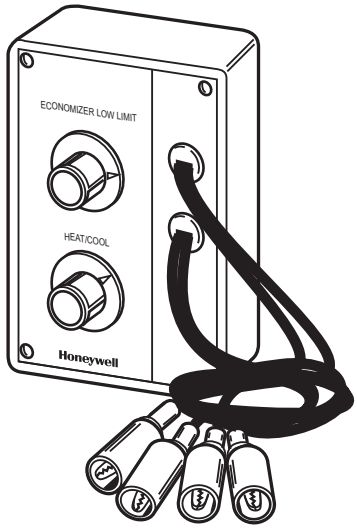
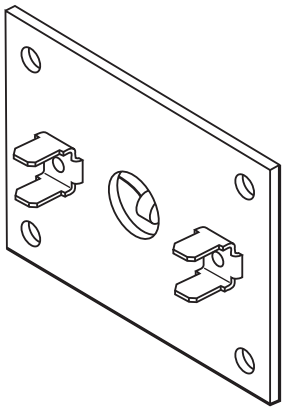
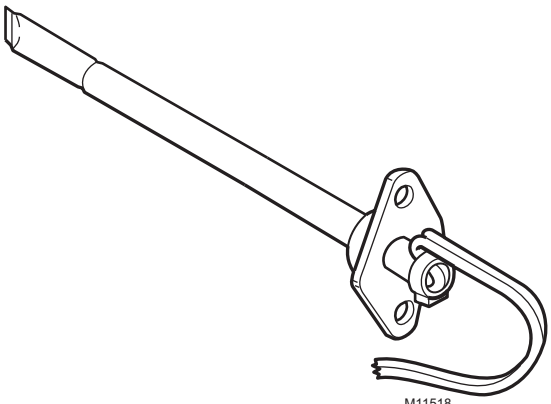
Volatile Organic Compound (VOC)—One of a class of chemical components that contain one or more carbon atoms and are volatile at room temperature and normal atmospheric pressure. In indoor air, VOCs are generated by such sources as tobacco smoke, building products, furnishings, cleaning materials, solvents, polishes, cosmetics, deodorizers and office supplies.

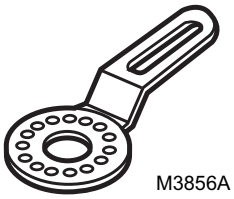
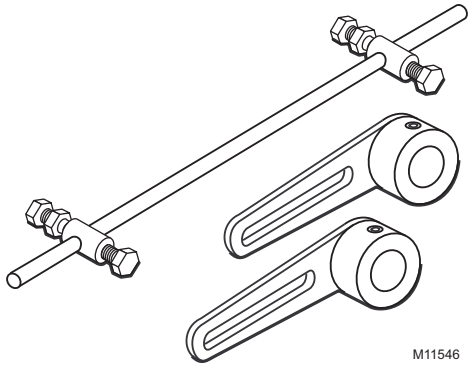
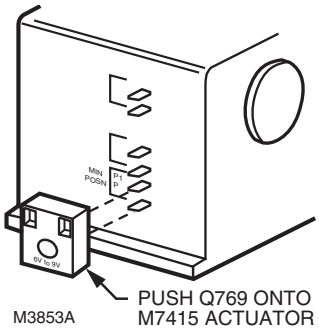
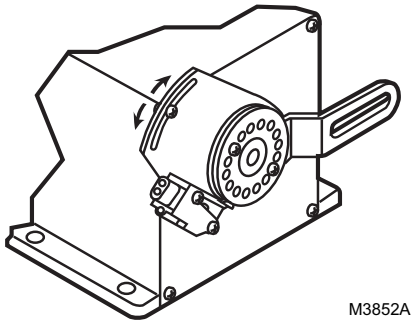
'Wild Economizer'—A mixed air control circuit in which outside air is used virtually on a continuous basis whether or not there is a call for cooling from the controlled area. This can be very inefficient in some applications and raise heating costs.

Zoning—The practice of dividing a building into sections for heating and cooling control so that one controller is sufficient to control the heating and cooling requirements for the section.

Accessories for the M74XX Series Actuators

4074EHB Screw Terminal Adapter—converts quick-connect terminals to screw terminals. Adapter can be used with or without 7640QF	 M11523 **4074 EHB**
7640QF Terminal Enclosure—provides wiring enclosure for electrical terminal connections. Enclosure can be used with or without 4074EHB Screw Terminal Adapter. Bag assembly includes: terminal housing, cover plate	 M11519A **7640QF**
Q709A Actuator Mounted Minimum Position Potentiometer—permits adjustment of minimum damper position and provides quick-connect terminals for remote minimum position potentiometer	 M11535 **Q709**

S963B1136 Minimum Position Potentiometer— permits remote adjustment of minimum damper position; can be used with or without Q709A Actuator Mounted Minimum Position	 M11548A **S963**
C7150B1004 Mixed or Discharge Air Thermistor Sensor—use with M7415A proportioning	 M11533 **C7150B**
C7046 Discharge Air Sensor—use in place of C7150B1004 if desired.	 M11518 **C7046C**

4074EGR Crank Arm Assembly	 M3856A
Q298B Linkage Hardware—enables linking the actuator to an additional damper. Consists of two crank arm assemblies, two ball joint assemblies, and variable length push rods (in 10, 16, or 24 inch lengths)	 M11546 **Q298**
Q769A 6 to 9 volt Adapter for M7415A actuator—enables the actuator to be proportionately modulated with a 6 to 9 Vdc signal. The Q769A may also be used in lieu of a Q709A to control the minimum position of an M7415A with a 6 to 9 Vdc signal when a C7150B is used as a temperature sensor. **Q769B** 4 to 20 mA Adapter for M7415A actuator—enables the actuator to be proportionately modulated with a 4 to 20 mA signal. The Q769B may also be used in lieu of a Q709A to control the minimum position of an M7415A with a 4 to 20 mA signal when a C7150B is used as a temperature sensor	 M3853A
4074EKV Auxiliary Switch—provides switching capability for controlling auxiliary equipment. The switch acts as a function of the actuator shaft position	 M3852A
Adapters and potentiometers are available to be installed directly on actuator or on W7459 controller.	

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422-3992
customer.honeywell.com

Honeywell Limited-Honeywell Limitée.
35 Dynamic Drive
Toronto, Ontario M1V 4Z9

Honeywell

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